Compressed Air Magazine

FEBRUARY 1957

TACKLING SUEZ CLEARING TASK

British diver surfaces after examining sunken ship near Port Said

(SEE INSIDE PAGE)

VOLUME 62 • NUMBER 2 NEW YORK • LONDON

STAYNEW® FILTERS

Dollinger makes ALL TYPES of filters as shown on this page, plus special filters for unusual filtration problems. New users of one specific type of Staynew filters often find a second Dollinger filter performs a great, added service in other processes or operations. Perhaps we can serve major or other filtration needs of your plant.

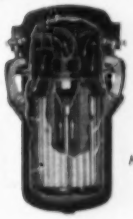
LIQUID FILTERS

Model HE (Sump)
Liquid Filter
Bulletin 330

Model ELS (Pressure)
Liquid Filter
Bulletin 300

PIPE LINE FILTERS

Model CPH
Pipe Line Filter
Bulletin 200



Model CVH (Vacuum)
Pipe Line Filter
Bulletin 200

Model AAPHS
(Absorption)
Pipe Line Filter
Bulletin 200

Model HPH and AHPH
(High Pressure)
Pipe Line Filter
Bulletin 200

all types of FILTERS for every INDUSTRIAL NEED

AIR INTAKE FILTERS

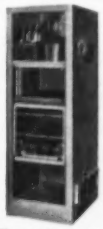
Model IDR
(Ground Level)
Air Intake Filter
Bulletin 100

Model DS (Silencer)
Air Intake Filter
Bulletin 100

Model D (Outdoor)
Air Intake Filter
Bulletin 100

Model C (Indoor)
Air Intake Filter
Bulletin 100

VENTILATION FILTERS



Electro-Staynew
Mist Collector
Bulletin 420

Electro-Staynew
Precipitator
Bulletin 400

Automatic
Ventilation Filter
Bulletin 500

Dry and
Viscous Panel
Ventilation Filters
Bulletin 600 and 700

DOLLINGER
REG. PROTECTOMOTOR U.S. PAT. OFF.
STAYNEW FILTERS

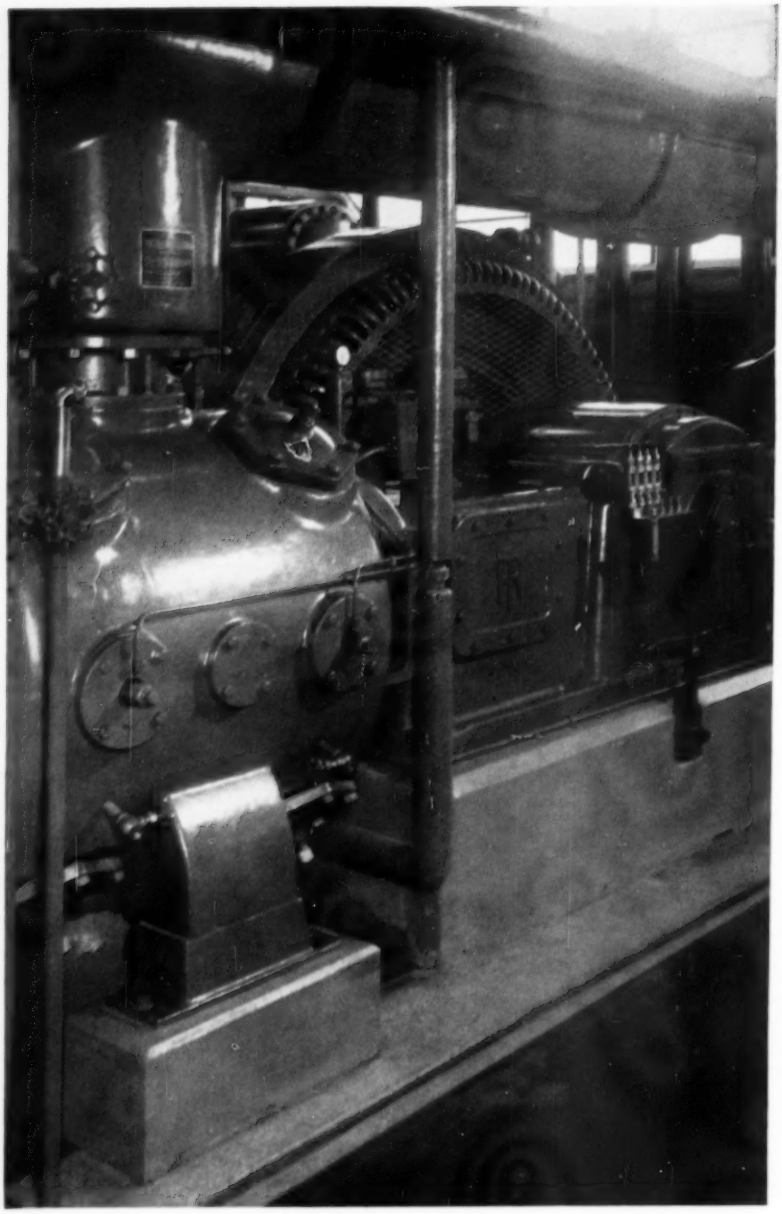
DOLLINGER CORPORATION
CENTRE PK.
ROCHESTER 3, N. Y.

Write, using Bulletin Numbers, for complete information on any of the Staynew filters illustrated. Consult Dollinger engineers on any special filtration problems—no obligation. Dept. 7 Centre Park, Rochester.

LIQUID FILTERS, PIPELINE FILTERS, INTAKE FILTERS, HYDRAULIC FILTERS, ELECTROSTATIC FILTERS, DRY PANEL FILTERS, VISCOUS PANEL FILTERS, LOW PRESSURE FILTERS, HIGH PRESSURE FILTERS, AUTOMATIC VENTILATION FILTERS, NATURAL GAS FILTERS, SPECIAL DESIGN FILTERS, SILENCER FILTERS

Circle 2A on reply card

"It keeps systems free of rust and harmful deposits"



Based on his experience with ***Texaco Regal Oil R & O*** *for all air compressor lubrication, the Plant Manager for a famous appliance manufacturer (name on request) wrote us:*

"Texaco Regal Oil R & O has done a consistently fine job for us. It keeps systems free of rust and harmful deposits — and we haven't had to replace a bearing since we started using it."

OPERATORS everywhere enjoy similar benefits. *Texaco Regal Oil R & O* is refined to premium quality, then further improved by special additives that inhibit rust and oxidation. The results are high efficiency, dependable performance, low maintenance costs.

There is a complete line of *Texaco Regal Oils R & O* to meet the requirements of all compressors and operating conditions. A Texaco Lubrication Engineer will gladly help you select the proper one. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

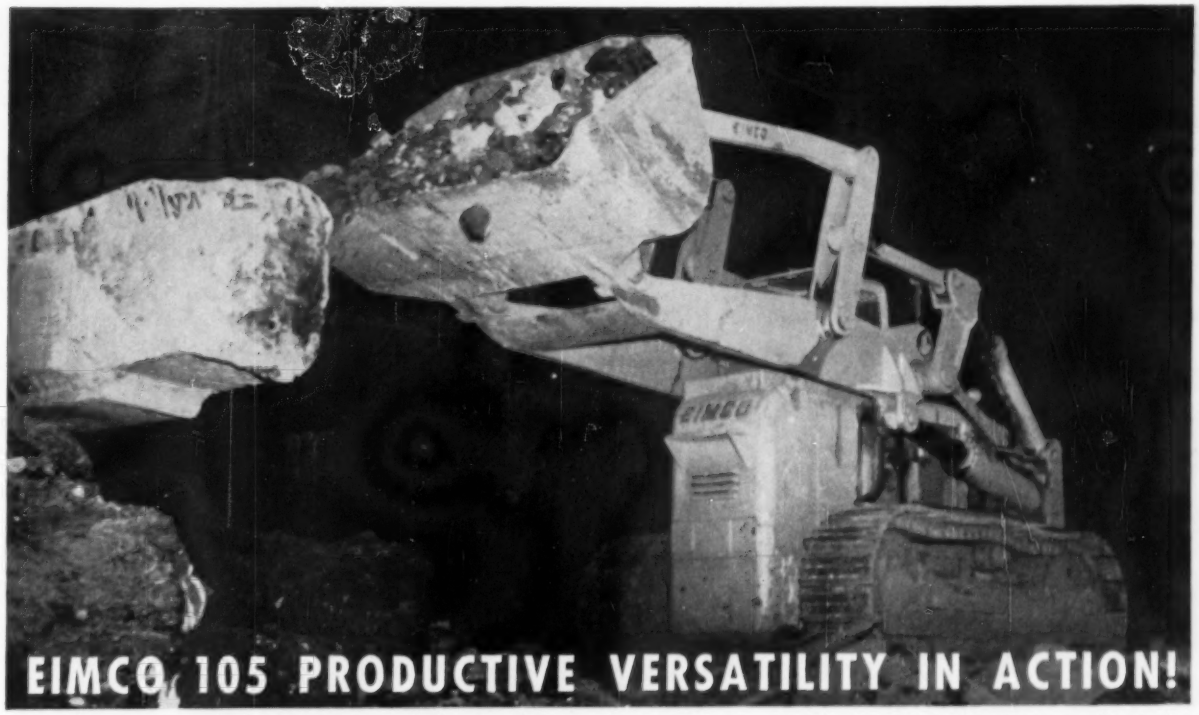
TEXACO REG. T.M.

TEXACO Regal Oils R & O

FOR ALL AIR COMPRESSORS AND OPERATING CONDITIONS

TUNE IN . . . METROPOLITAN OPERA RADIO BROADCASTS EVERY SATURDAY AFTERNOON

Circle 1A on reply card



EIMCO 105 PRODUCTIVE VERSATILITY IN ACTION!

NEW! FRONT END LOADER

Here's the latest addition to the 105 wide-range family of rugged earth-moving tools.

In loading applications where physical and haulage conditions make its use more practical . . . here is a front end loading mechanism that gives you extra strength for the most severe job.

Large, double-acting hydraulic boom cylinders provide ample power to hoist loads weighing up to 15,000 lbs. to full height. Boom and bucket controls may be operated simultaneously.

To fill the big (2½ yard) bucket, this loader develops 25,000 lbs. digging force at the lip. 40,000 lb. pry-out force and 40 degree bucket tip-back at ground level gets full bucket loads, minimizes spillage. It carries loads close and low for maximum stability.

It operates in 9' 6" headroom . . . discharges into haulage units up to 14'.

Exclusive features of the hydraulic system provide an extra margin of protection against mechanical delays.

Bulldozer

Dozer blade attachments are designed to make full use of the extra-production features of the 105. In broad usages such as cutting haul roads for logging outfits . . . pioneering in shale and hard rock . . . clearing fire paths for the Forest Service . . . the Eimco 105 Bulldozer has proven its high-capacity ability the world over.

All attachments are Eimco-built to standard SAE mounting dimensions for the basic 105 Tractor. This means extra performance from every attachment through independent track maneuverability . . . up front visibility . . . power shift operating ease . . . balanced design for maximum stability . . . quality built for dependable on-the-job service.

Excavating Loader

Where digging is extra tough . . . and haulage provisions can be adopted to take full advantage of overhead discharge — the time-proven 105 Excavating-Loader will give you **bonus** loading power at the bucket lip and **bonus** dumping speed to accelerate the entire cycle.

Unique contour of the rugged rocker arms . . . bucket design and smooth, steady flow of engine power transmitted to the bucket lip through the torque converter gets 39,200 lbs. of digging force right where you want it . . . in the pile. Awkward maneuvering to get into dumping position is eliminated in ideal overhead discharge applications.

THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Pittsburgh, Pa. Seattle, Wash.
Cleveland, Ohio Houston, Tex. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

EIMCO

B-239

ANNOUNCING

HANKISON
MAG-PNEU-POWER Trap

A MASTERPIECE OF DESIGN

APPROX. ⅔ ACTUAL SIZE

MODEL 501

1 MAGNETIC SNAP-ACTION
operates pilot valve

2 POWER OPERATION
using the energy in your pneumatic system

3 AUTOMATIC MECHANISM
only TWO moving parts

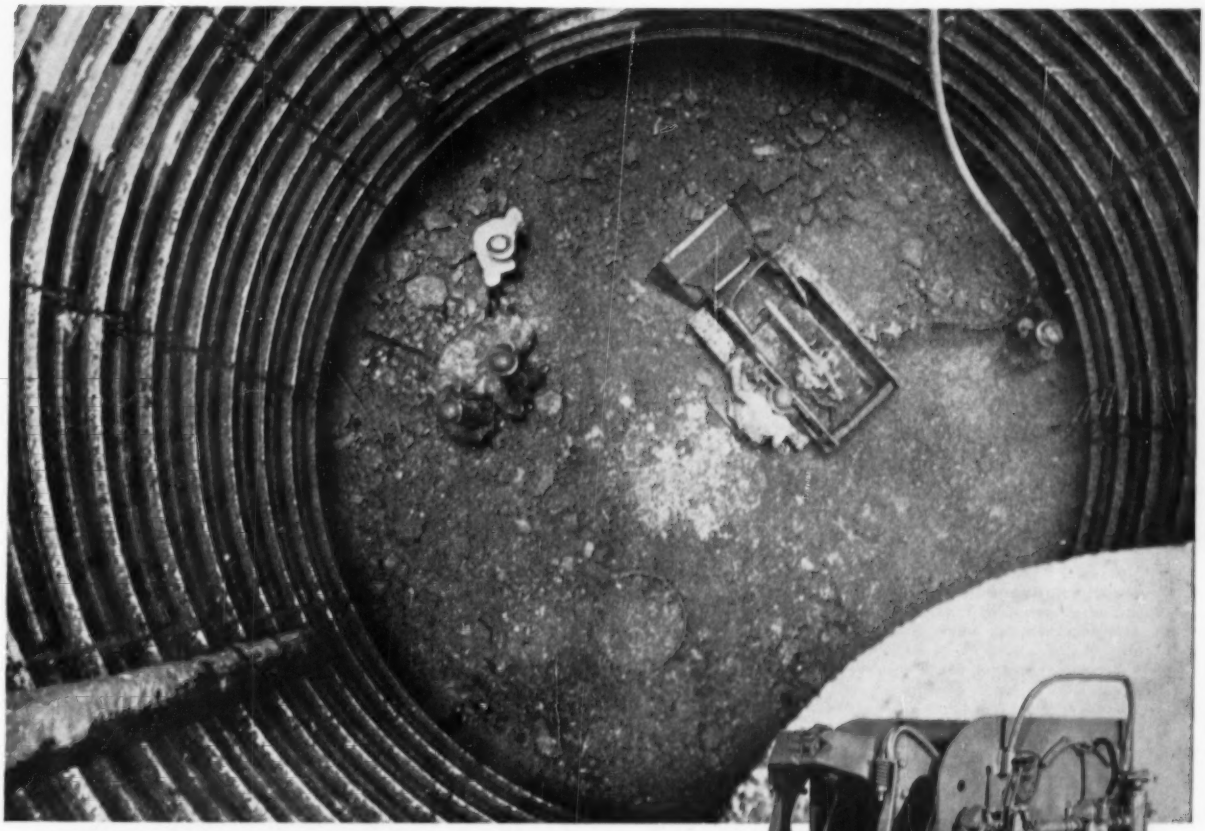
PRESSURE RANGE 10-200 PSIG

Now . . . power-action condensate discharge for all compressed air and gas lines!

Write for Bulletin 501

HANKISON CORPORATION
951 BANKSVILLE ROAD · PITTSBURGH 16, PA.

HC-15



MINERS USE EIMCOS WHERE PROFIT DEPENDS ON HIGH PRODUCTION

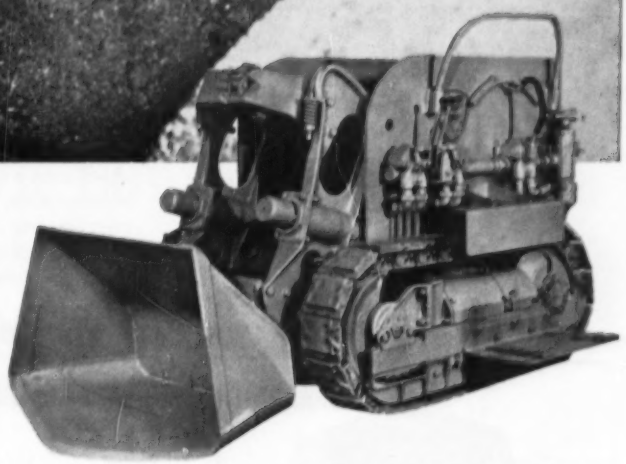
At exploration projects . . . and mucking low-grade ore where profit is realized only when high tonnage quotas are met — the Eimco 630 Crawler-Excavator is expanding production opportunities.

Increased demand for the versatile 630 by firms who previously were stymied in exploration and development projects because of tonnage requirements . . . is proof that Eimcos are helping to solve this production problem.

The 630 also is helping to recover large, low-grade ore bodies through exploration of deeper horizons. Areas that other underground development hasn't touched during years of continuous mining activity, are now worked profitably.

One important phase of these expansions is tough shaft sinking jobs. Often, occurrence of water adds to the already severe service conditions under which equipment must perform.

But as one superintendent put it, "We haven't had trouble digging the last feet of any wet shaft round with the Eimco and it really takes punishment."



Working in a 26 foot diameter shaft with mine-rail concrete lining . . . this Eimco 630 Crawler-Excavator is saving labor and maintenance costs while providing high tonnage production. Independent track maneuverability, operating ease and powerful, fast digging-loading ability makes the Eimco ideal for this application.

This is possible because the 6,000 lb. digging effort at the bucket lip gives the 630 tremendous crowding and digging power . . . enough to fill the big, half-yard bucket in any muck pile. And rugged construction with all vital parts protected against moisture and foreign material — insures long, on-the-job service.

In any underground excavating job . . . the standard Eimco 630 will permit you to increase your earning potential without addition of specialized machinery. Write today for full information!

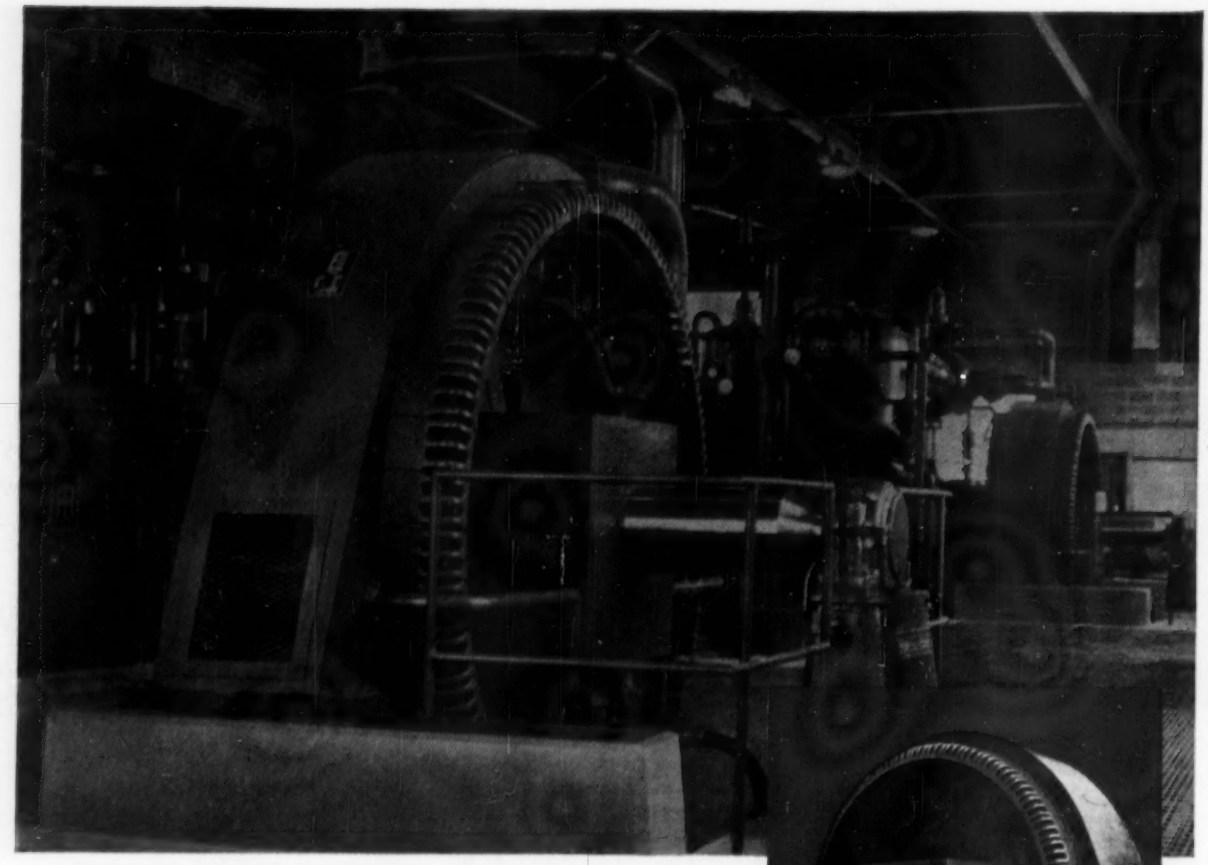
THE EIMCO CORPORATION

Salt Lake City, Utah—U.S.A. • Export Offices: Eimco Bldg., 52 South St., New York City

New York, N. Y. Chicago, Ill. San Francisco, Calif. El Paso, Tex. Birmingham, Ala. Duluth, Minn. Kellogg, Ida. Pittsburgh, Pa. Seattle, Wash.
Cleveland, Ohio Houston, Tex. London, England Gateshead, England Paris, France Milan, Italy Johannesburg, South Africa

B-360

Circle 6A on reply card

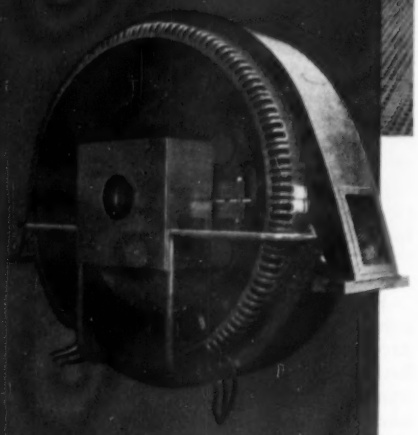


Large Elliott Motors power unique compressor installation

In a New England chemical plant, two 3500-hp, 300-rpm Elliott synchronous motors furnish the power to drive compressors which are the heart of an ammonia process. The unique feature of the installation is that the compressors each provide *four* services, one more than has ever been attempted before.

The motors are started across the line, being brought up to speed and field-applied in four to five seconds with a minimum of disturbance to the system voltage and a momentary frequency drop of less than 0.5 cycle. An Elliott 7500-kw turbine-generator, operating as an isolated unit, is used for starting.

Elliott offers broad experience in many fields of motor applications to assist users in achieving greatest economy and dependability of service. Consult the nearest Elliott District Office, or write Elliott Company, Ridgway Division, Ridgway, Pa.



Built to stand up on the toughest jobs

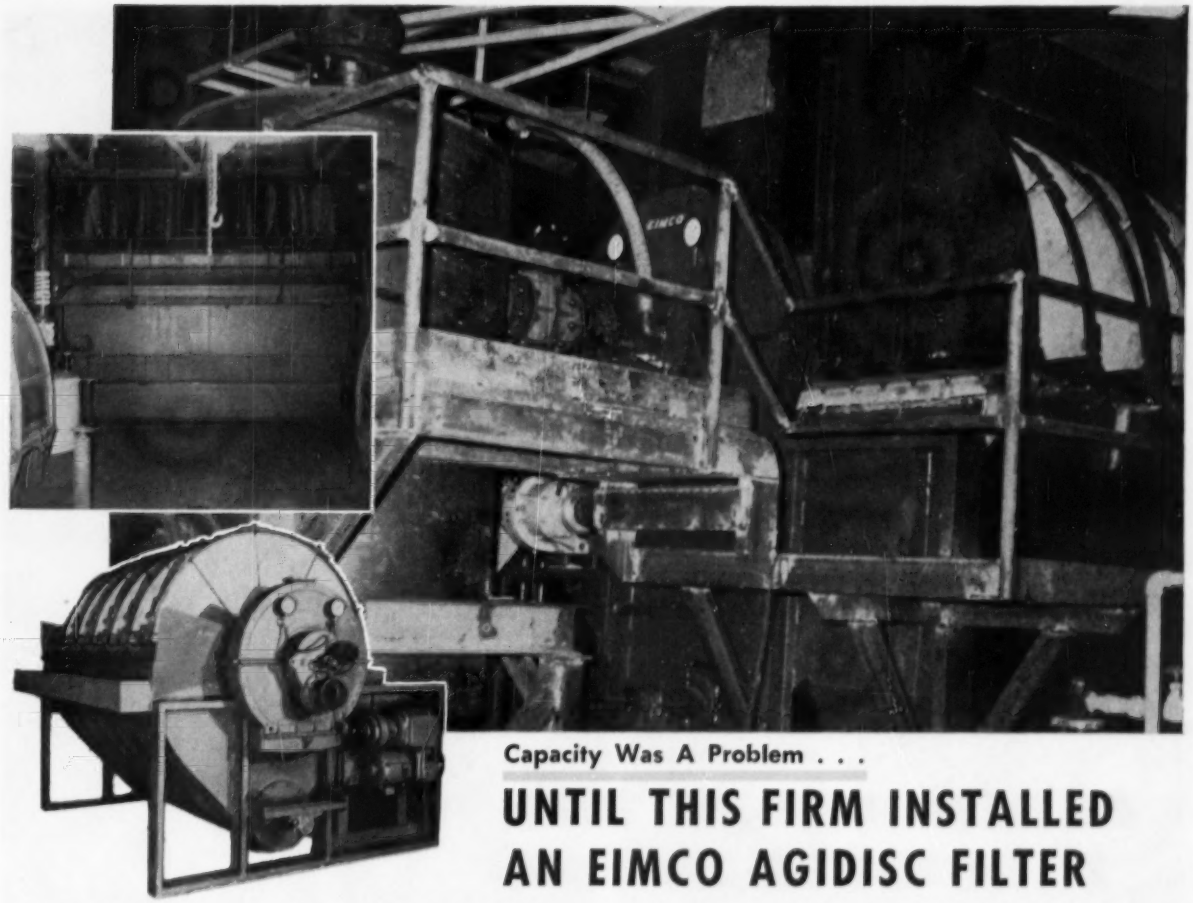
The rigid Fabristeel construction, unequalled insulation protection and other features of Elliott large motors give them the stamina to withstand the most severe service. The motor shown above is one of those installed in the plant illustrated in the photograph at the top of the page. Its rugged construction is apparent.

ELLIOTT Company

RG-18

STEAM TURBINES • MOTORS • GENERATORS • DEAERATING HEATERS • EJECTORS • CONDENSERS • CENTRIFUGAL COMPRESSORS • TURBOCHARGERS • TUBE CLEANERS • STRAINERS

Circle 5A on reply card



Capacity Was A Problem . . .

UNTIL THIS FIRM INSTALLED AN EIMCO AGIDISC FILTER

Installation of an Eimco Agidisc Filter was made by a large nickel producing firm after a competitive-make of disc-type filter could not handle a nickel ammonia leach residue at the required production level.

Replacement of the 8′ 6″ × 10 disc filter with an 8′ 10″ × 10 disc Eimco Agidisc resulted in these production efficiencies:

	ORDINARY DISC-TYPE	EIMCO AGIDISC
PRODUCTION COMPARISON	940 sq. ft. of filter area in 10 discs. It was necessary to by-pass one-fourth of tonnage past the filter to maintain required production level. Processed 17 tons of concentrate per day (75% of tonnage required for profitable operation).	1040 sq. ft. of filter area in 10 discs. Efficiently handles the tonnage that formerly was by-passed. Processes 24 tons of concentrate per day. With an increase of **25%** in filter area, the Eimco has boosted capacity by **40%.**
OPERATING EFFICIENCY	75% production efficiency was achieved only through considerable manual assistance. Excessive down time for filter tank cleaning.	In achieving 100% production efficiency, Eimco uses efforts of one man part time. Maintenance and labor costs are much less.
PRODUCT EXCELLENCE	Poor cake discharge required manual assistance. Uneven cake formation. Severe classification rings on outer periphery of disc with thin, slimy cake near center.	Efficient cake discharge without manual assistance. Ability of Agidisc to maintain uniform particle suspension has resulted in even, dry cake formations.

Outstanding success of the Eimco Agidisc Filter prompted this firm to convert five other disc filters into Agidiscs. They are convinced these installations are securing a ton of concentrate at the lowest cost per dollar of investment and maintenance.

Increasing the efficiency of your plant means greater returns. The Eimco Research and Development Center is staffed and equipped to help you solve your filtration problem whatever it may be. They'll be happy to assist you!

THE EIMCO CORPORATION

SALT LAKE CITY, UTAH

Research and Development Division, Palatine, Illinois • Process Engineers Inc. Division, San Mateo, California
Export Offices: Eimco Building, 51-52 South Street, New York 5, N. Y.
BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

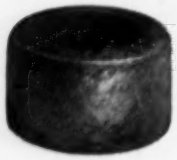
B-241

Circle 8A on reply card

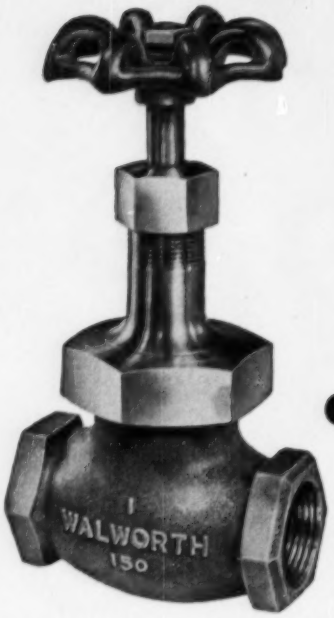
WALWORTH

Toothed Lock Washer: Prevents loss of stem nut due to vibration, thereby holding the handwheel securely.

Newly Designed Handwheel: Air-cooled, finger grip handwheel affords sure grip even with greasy gloves.



Improved Packing: Molded packing of lubricated asbestos reinforced with copper wire. Suitable for practically every service. Valves can be repacked under pressure.



IMPROVED
No. 95
BRONZE
GLOBE VALVE

also available in Angle Type (No. 96)

The service ratings of the Walworth No. 95 are 150 pounds per square inch steam at 500F, and 300 pounds per square inch non-shock cold water, oil, and gas. In the manufacture of this quality bronze valve, more than 47 gages are used in machining parts to micrometric accuracy, thus insuring interchangeability of parts. For further information see your local Walworth distributor, or write: Walworth Company, 60 East 42nd St., New York 17, N. Y.

note these 7 Great Features

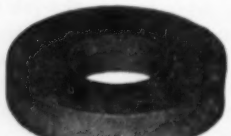
Hexagonal Union Bonnet Connection: Eliminates any chance of distortion or leakage even though valve is repeatedly taken apart and assembled.

WALWORTH
valves and fittings

60 EAST 42nd STREET NEW YORK 17, N. Y.

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

New Cylindrical Disc Holder: The design of the top portion of the disc holder keeps the disc accurately guided under all operating conditions.



Renewable Asbestos Disc: This disc is suitable for steam up to 500F and is resistant to oil, gasoline, and many chemicals at atmospheric temperatures. Discs for special services are available.

Extra Strong Body: Made of Composition M (ASTM B61) bronze thick enough to provide a high safety factor. Valves undergo hydrostatic shell test of 450 psi.

Circle 7A on reply card

Bethlehem Hollow Drill Steel provided outstanding service in construction of New Haven Water Company's Genesee Tunnel. *Contractor:* Coker Construction Company and Peter Kiewit Sons Company, Omaha. *Engineers:* Malcolm Pirnie Engineers, New York.

Man-Made River to Flow Underground

To augment its facilities, the New Haven Water Company is busily engaged in constructing the Genesee Tunnel, a 9½-ft bore, 21,516 ft long, near New Haven, Conn. When placed in operation in 1957, the rock-faced tunnel will divert water from the Hammonasset River to Lake Gaillard, a storage reservoir. This will increase the safe yield of the lake by about 20,000,000 gallons per day.

Building the tunnel calls for the removal of 61,000 cu yd of granite, gneiss and quartz. Bethlehem Hollow Drill Steel, in 1-in. hexagons and 1⅛-in. rounds, and fitted with carbide-insert bits, was used in drilling most of the 8-ft blast holes. It stood up well, providing low cost per foot of hole. Reconditioning was handled at the tunnel site.

Whether you have a tunnel or some other type of rock drilling planned, you can be sure of economical drilling with Bethlehem Hollow. This top-quality drill steel is rolled from fatigue-resisting steel. Its uniform hole is centrally located in the bar. Bethlehem Hollow also has a wide quenching range, making it easy to heat-treat for the proper balance of toughness and wear-resistance. It also makes possible long-wearing threads and sturdy shanks.

Bethlehem Hollow comes in carbon and ultra-alloy grades in rounds, hexagons and quarter-octagons. It is furnished in lengths of from 18 ft to 25 ft, although longer lengths are also available. Specify Bethlehem Hollow for your next job.

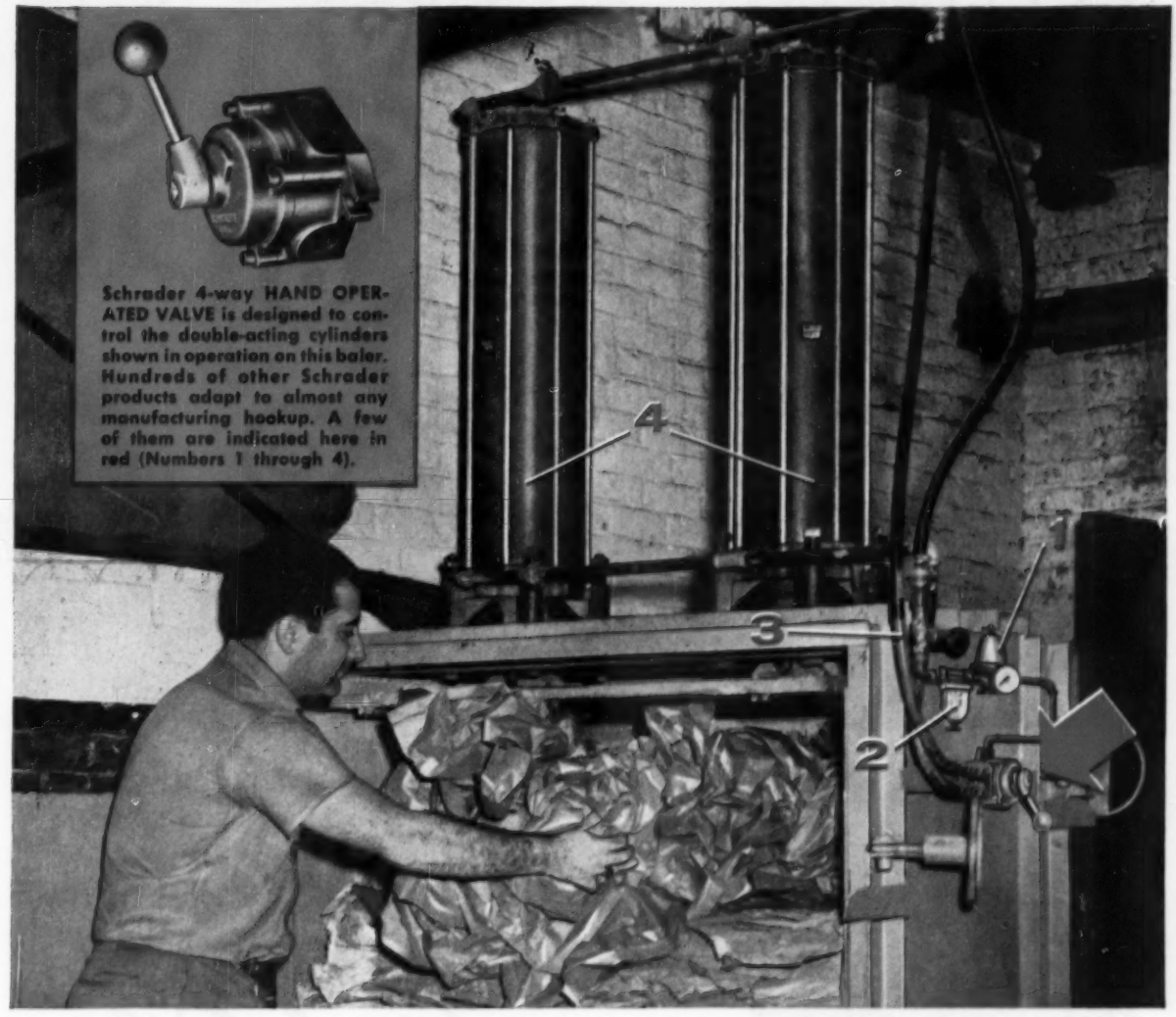
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM HOLLOW DRILL STEEL CARBON *AND* ULTRA-ALLOY

BETHLEHEM STEEL

Circle 9A on reply card


Schrader 4-way HAND OPERATED VALVE is designed to control the double-acting cylinders shown in operation on this baler. Hundreds of other Schrader products adapt to almost any manufacturing hookup. A few of them are indicated here in red (Numbers 1 through 4).
4
3
2

How Schrader Air Products bale paper, producing 4 ton pressure with 100 lbs. of air

At this Rhode Island dye works, the paper baling operation formerly was a fatiguing manual chore. Now, the operator simply fills the press with used paper and cartons, and pulls a 4-way hand valve. One hundred pounds of air pressure flowing through the two Schrader double-acting cylinders then compress the paper with four tons of force. Finger-tip adjustments can reduce or raise pressure quickly, easily.

Safe, simple, fast—compressed air daily performs miracles in hundreds of different ways. More and more manufacturers think "air" when they think "automation." Holding work, moving scraps, synchronizing actions—all such operations can be automated with Schrader Air Products.

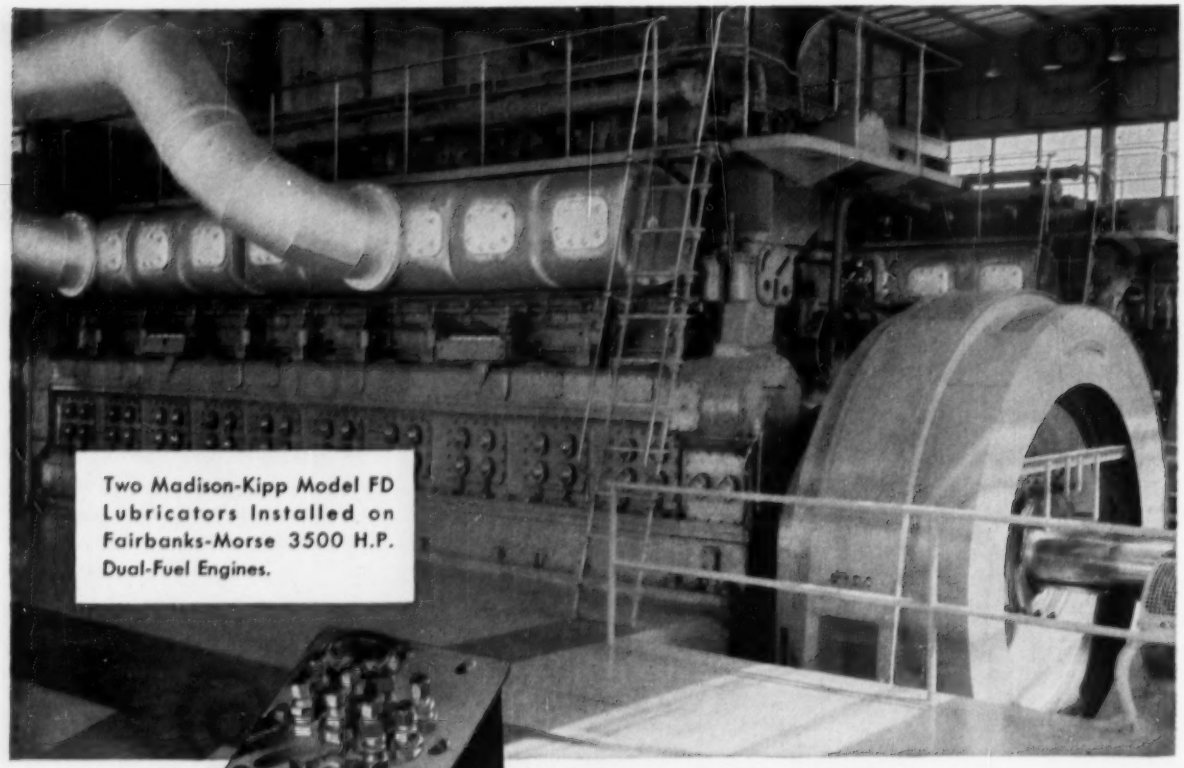
Air means economy, too. Upon request, Schrader engineers will assist you in planning for the most efficient use of air and in selecting the products best suited to your applications. Tell us your problems. We'll be glad to help. Or send for the latest informative booklets.

Schrader®
ESTABLISHED IN 1844

A. SCHRADER'S SON
Division of SCOVILL
478 Vanderbilt Avenue, Brooklyn 38, N. Y.

FIRST NAME IN THE USE OF AIR
FOR INDUSTRIAL PRODUCTION AND CONTROL

Circle 10A on reply card



Two Madison-Kipp Model FD Lubricators Installed on Fairbanks-Morse 3500 H.P. Dual-Fuel Engines.

Machines of great performance use the most dependable oiling system ever developed

MADISON-KIPP

Fresh Oil

...by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy, where oil under pressure fed drop by drop can be installed. There are 6 models to meet almost every installation requirement.

kipp

MADISON-KIPP CORPORATION
202 WAUBESA STREET • MADISON 10, WIS., U.S.A.

Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

Circle 11A on reply card

One DRILLMASTER replaces four churn drills!

At the above open pit mine, one DRILLMASTER is now doing the work formerly requiring four churn drills. It is sinking 6" blast holes to a depth of 75 to 180 feet, with a 15 foot hole spacing and 20 to 25 foot burden. *All blast holes are drilled by the Drillmaster at a 15° angle from the vertical in order to take full advantage of bedding planes and to overcome a severe toe problem.* DRILLMASTER Carset Jackbits are delivering a total life of up to 4000 feet of hole.

The "down the hole" Depth-Master drill is a feature of the Ingersoll-Rand DRILLMASTER. Going down the hole with the bit, it applies full drilling impact directly to the bit at any depth of hole. Thus the power losses in long drill steels are avoided. The DRILLMASTER can also be used as a Rotary drill or as an "out of the hole" Power-Master drill.

Complete packages — including tower and accessories — are available for tractor or truck mounting. For further details, send for Bulletin 4179.

Ingersoll-Rand

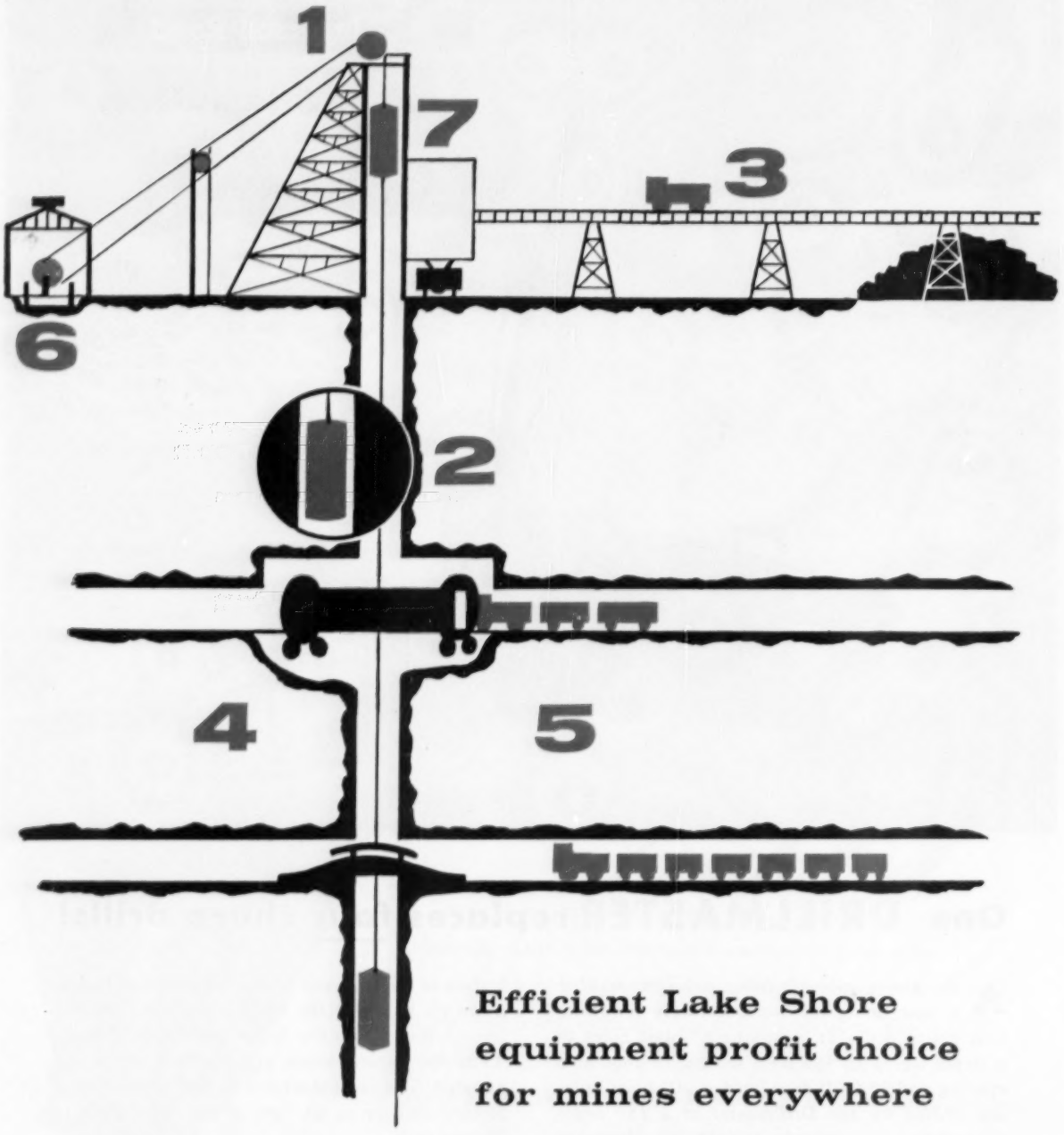
11 Broadway, New York 4, N.Y.

5-425

DRIFTERS • JACKDRILLS • JACKHAMERS • WAGON DRILLS • CARSET BITS • AIR TOOLS • COMPRESSORS

Circle 12A on reply card

SEVEN PLACES TO



Efficient Lake Shore equipment profit choice for mines everywhere

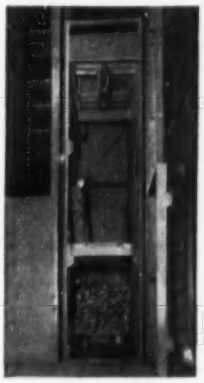
Key to lower mining costs is efficient, dependable equipment. That's why, for almost a century, leading companies have constantly picked Lake Shore mining machinery to maintain highest production at lowest cost.

The points on this diagram summarize the general product lines produced in our Iron Mountain and Marquette plants. The variety of standard mining equipment manufactured by Lake Shore runs into the hundreds—yet no job is too big, too small or too special for our design and engineering facilities.

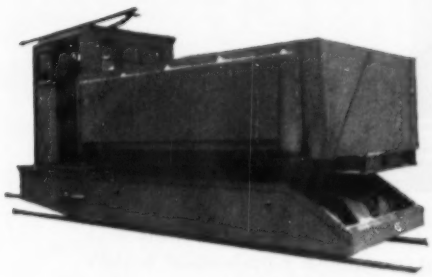
Keeping ore handling costs in line is a big job. But it can be much easier if the equipment you use has the quality and lasting, low-cost performance features that are built into every Lake Shore product. Specific information on our standard products specially designed to your needs, is yours free. Contact your nearest Lake Shore Branch, or write for product bulletins.

CUT MINING COSTS

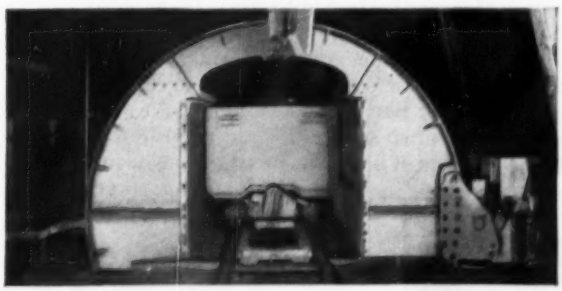
1 Lake Shore Idler, Carrying and Head Sheaves are available in many sizes and types. A new fabricated sheave represents the latest in design and construction.



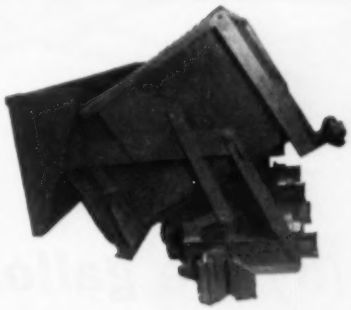
2 This double deck 80-man cage is one of many different types of vertical and inclined cages obtainable. Combination skip and cage also available for various requirements.



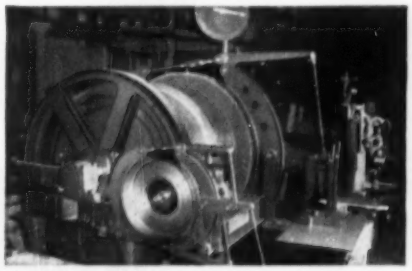
3 Trestle cars of all types are designed to individual specifications. Fit many applications.



4 Car dumpers for various special operations are available. This rotary dumper is one unit. Also camelbacks and other dumpers.



5 Lohed tram car in dump position shows strong, lightweight construction. Dumps clean every time. A complete line of mine and man cars.



6 Many new and original features in hoist design and construction, incorporated in Lake Shore hoists, have set new standards of performance and safety in many mines. This is one of many offered by Lake Shore.

7 Vertical skips, inclined skips—all from Lake Shore. The patented "Jeto" bottom dump skip is shown here. Also Kimberly skips. For every shaft or headframe.

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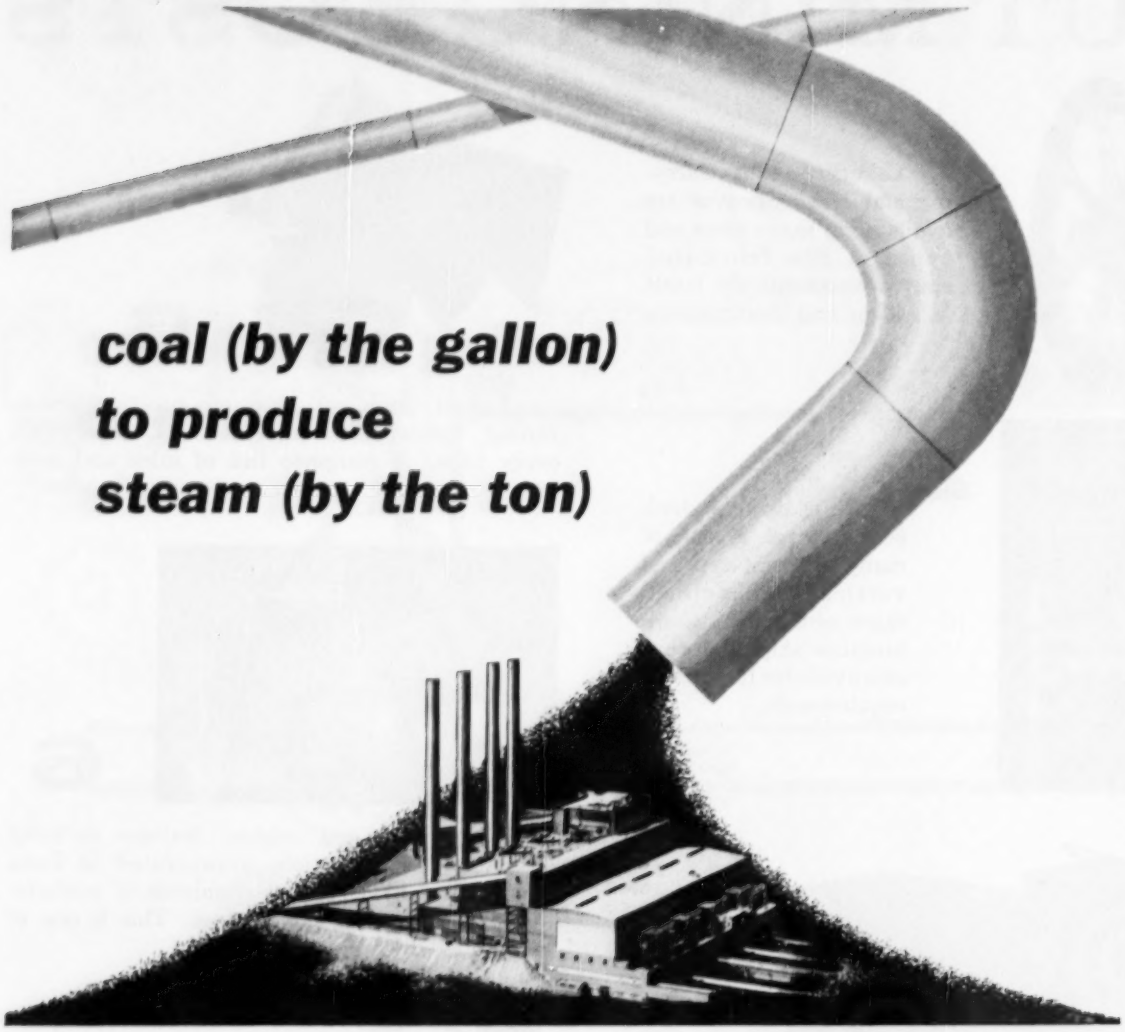

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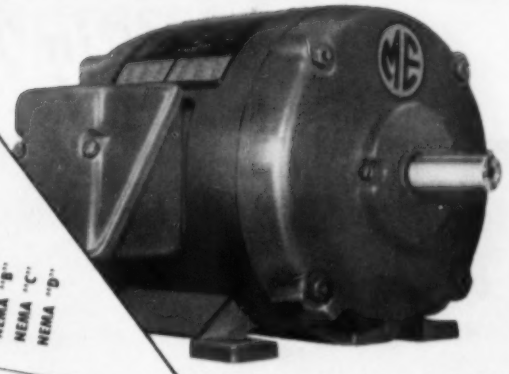

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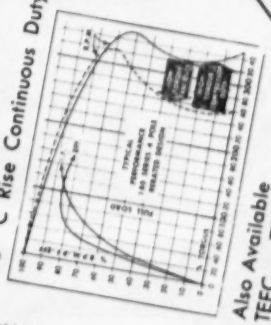

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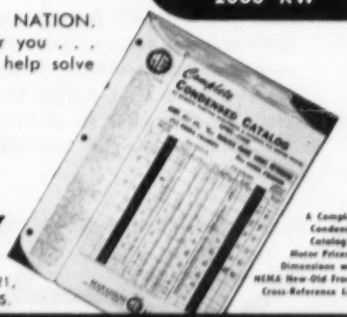

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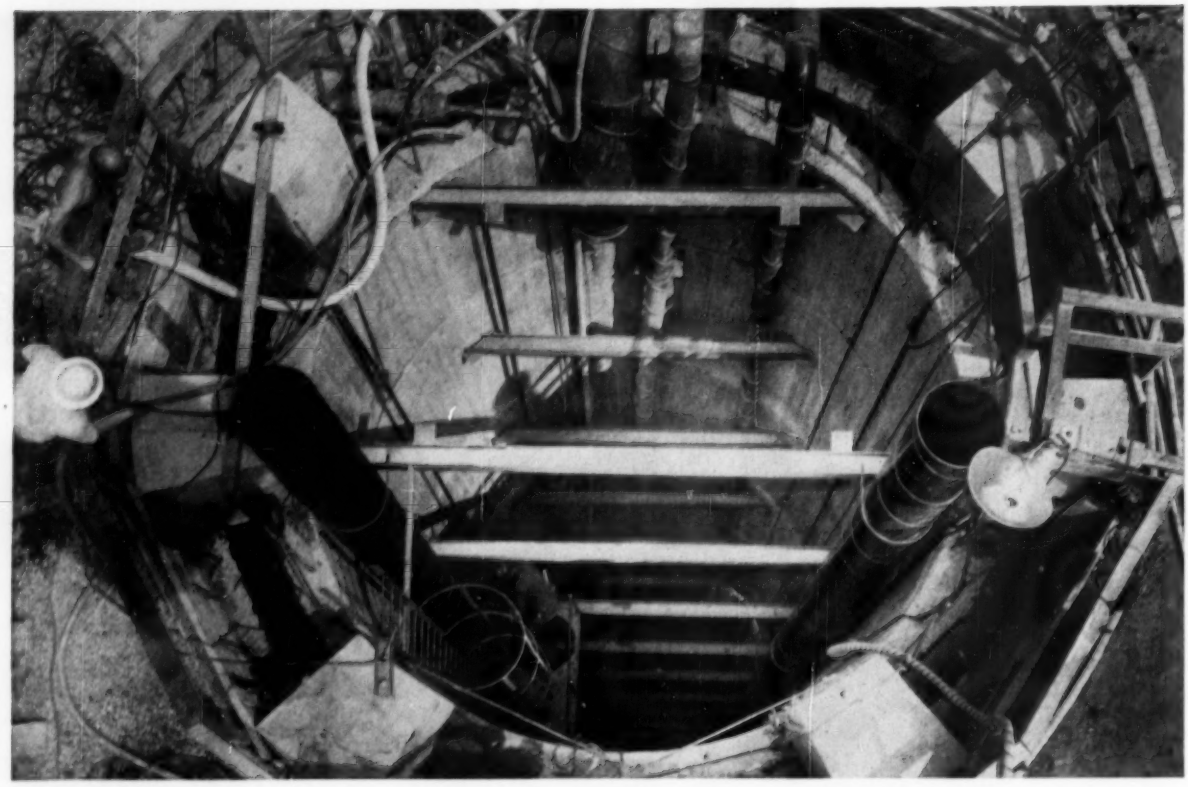

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ON THE COVER

A SALVAGE fleet of 36 vessels is working at full speed to clear the Suez Canal of the obstructions left in the wake of the Anglo-French invasion of last October. The United Nations' force, under the direction of Lt. Gen. Raymond A. Wheeler of the United States, has ships from West Germany, the Netherlands, Denmark, Sweden, Italy, Great Britain, France and Belgium. A careful check showed 44 obstructions, including freighters, tankers, two car ferries, one dredge and two bridges that had been blown up.

At first it was ruled that only nations that had not taken part in the attack on Egypt would be permitted to join in the salvage work. This was later amended to include half a dozen ships from the British fleet that was already on the job.

Early in January the northern or Port Said end was sufficiently cleared to allow thirteen trapped vessels to leave the canal through that exit. This involved turning them around in the narrow waterway and threading a course past wrecks that still partly blocked the way. Indications are that the canal will be open for the passage of ships of up to 10,000 tons by March 1 and entirely clear before May.

Divers are vital to the clearing operation and the first step is to send them down for an underwater survey followed by a report for the guidance of subsequent salvage work. Our cover picture shows British diver Alexander Robertson after coming up from examining the the sunken French ship *Paul Solente* (position marked by flag). Another partly submerged vessel is in the background. The picture was taken on December 30, just before the United Nations took over the clearing task, and while the British and French were working frantically to open the waterway that is essential to the fast shipment of petroleum from the Mideast to European ports. Resumption of normal traffic will put an end to rationing of oil in various countries and bring a welcome increase in revenues to France and England.

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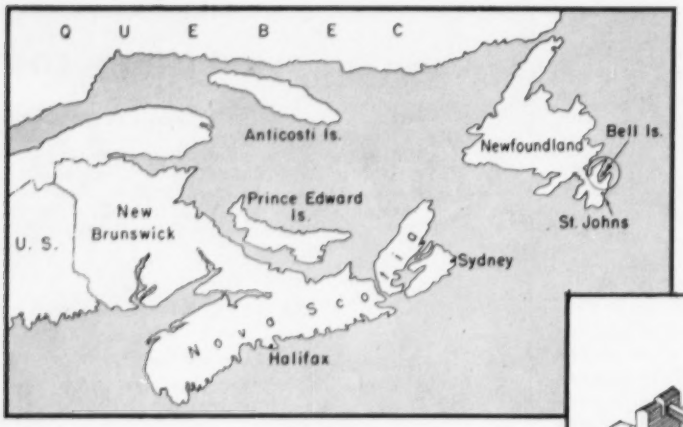
Mining Iron Ore Under the Sea

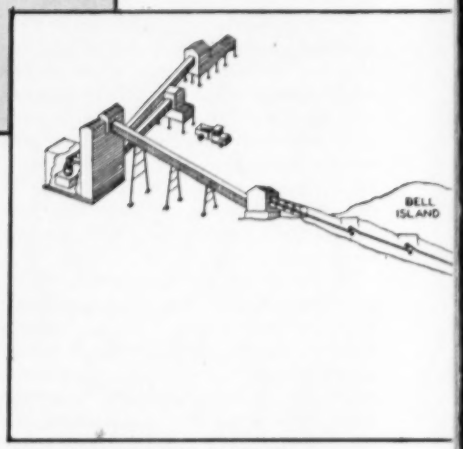
Wabana Operation Includes World's Longest and Steepest Mine Belt Conveyor

J. C. PIERCE



LOCATION MAP

Bell Island, a 2x6-mile speck of land, is in easternmost Newfoundland. It is about 440 miles from Sydney, N. S., where most of the iron ore is smelted. It is 995 miles from Boston, 1200 miles from New York and 1125 miles from Montreal. The mining operations support the island's population of 10,000.



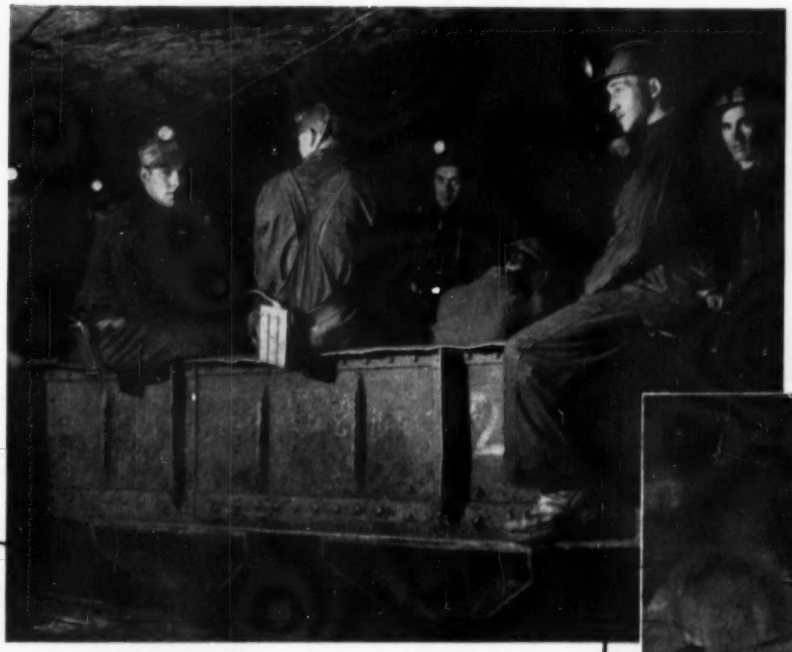
COURTESY, STEPHENS-ADAMSON MFG. CO.

MANY of the world's foremost mineral sources were found by chance rather than through the dogged pursuit of elusive clues or the application of modern scientific instruments and techniques. For example, strange pebbles picked up by school children on a Boer farm in South Africa led to the development of the fabulous diamond industry. Cowboy Bob Womack's interest in the unusual heft of a rock he had picked up to hurl at a stubborn steer resulted, according to legend, in the birth of the famous Cripple Creek gold camp in Colorado. Ore exposed in making a small cut on the Canadian Pacific Railway right-of-way near Sudbury, Ont., pointed the way to the largest known copper-nickel mining district. Heavy red rocks used for half a century by Newfoundland's fishing fleet as ballast and to weight crude anchors called "killicks," were recognized to be hematite—an important iron ore—when some of the boats discarded their ballast at Halifax, Nova Scotia. That was the clue which led to the exploitation of the iron deposits of Bell Island, Newfoundland, in 1895.

Bell Island is 13 square miles in extent and is a mass of vertical cliffs rising 220 feet above Conception Bay on the southeast coast of Newfoundland. About 95 percent of its 10,000 inhabitants are supported by the mining operation (2000 to 2500 being directly employed) and are concentrated in the settlement of Wabana, an Indian word meaning "place of first light." The community is not the easternmost one on the American Continent, as this seems to imply, for St. John's, and a few smaller nearby towns on the mainland have that distinction. Three separate beds of workable iron ore were exposed for about 3 miles on the northeastern edge of the island and were found to dip approximately 8 degrees northwestward under the floor of the bay. Since their discovery 62 years ago they have produced more than 60 million tons of high-grade mineral and been a large contributing factor to the economic growth of the Dominion of Canada.

In 1899, a matter of importance occurred in Nova Scotia that was to give considerable impetus to the development of the Wabana deposits. It was the creation of the Nova Scotia steel industry by the Dominion Iron & Steel Company, Ltd., sponsored by the Dominion Coal Company as a means of increasing coal sales and smoothing out surges in that market. The lower bed at Wabana, including the portion beneath the land and 3 square miles offshore, had been purchased by Dominion in 1898 for $1 million and it was estimated that the iron ore reserves were virtually "inexhaustible." Hence, the infant steel industry was based to a large extent upon the assurance of an adequate supply of ore. Ample quantities of limestone and coal, as well as small iron deposits, were found near the site of the works at Sydney. Blast furnaces were blown in during February of 1901 with a mixture of iron ore from Wabana and from foreign sources. By the end of the year the open-hearth section was in operation and since then the mill has been using Wabana ore exclusively.

The surface ore on Bell Island was easily won by the early miners, and by 1910 underground workings were following the sloping beds out under the bay. Production is currently coming from points approximately 3 miles offshore and 2000 feet below sea level, or a maximum of 1600 feet below the floor of the bay. By keeping in step with progress in mine mechanization and by adopting mining methods in accordance with the peculiar conditions involved, the Wabana mines have gained a reputation for efficient operation. But, with the working faces advancing farther and farther outward and downward, the problem of bringing the ore to the surface has gradually become one of considerable magnitude. After careful engineering study it became evident that greater hoisting economy and increased domestic and foreign demands necessiated the installation of a conveyor system with associate facilities.



RIDING TO WORK

Having been lowered down the slope by tramway, these miners (left) have boarded empty ore cars for the trip to their working areas.

NATIONAL FILM BOARD PHOTO

DRILLING WITH JACKLEG

An Ingersoll-Rand J-40 Jackhamer supported on a Jackleg (below). The ore face shows the extensive jointing. The muck pile is made up of the characteristic rhomboid-shaped blocks into which the hematite breaks.

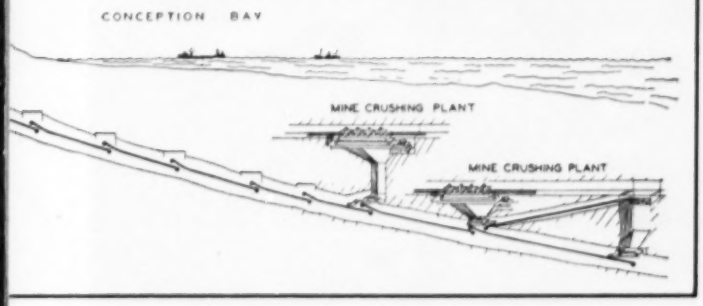


DIAGRAM OF CONVEYOR SYSTEM

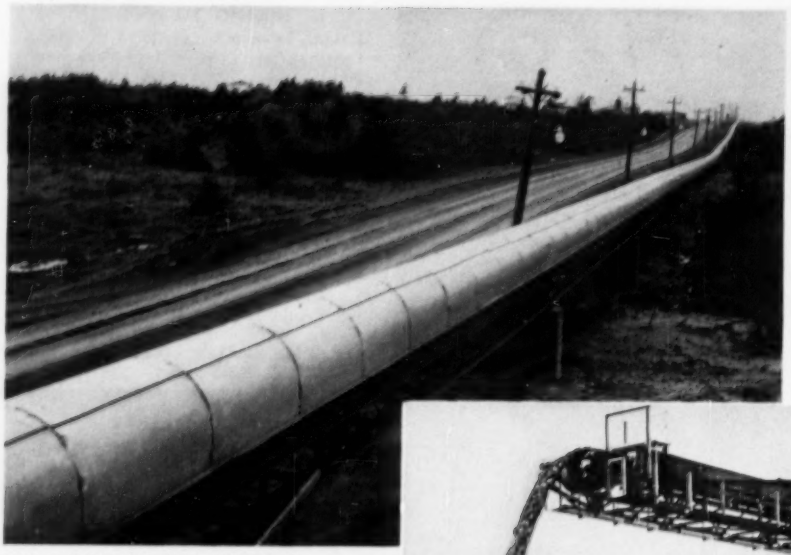
Reaching more than 2 miles into the mine on an 8-degree slope the "rubber railroad" system can transport 1000 tons of ore an hour to the surface, meanwhile lifting it nearly 1700 feet. The conveyor is arranged in ten flights of endless 36-inch belts that travel at a speed of 575 feet a minute. Approximately 5 miles of belting is utilized. Underground crushers reduce the ore to maximum 10-inch size before it is loaded.

The decision to launch this extensive $6,000,000 mechanization program was made in 1951 by the Dominion Steel & Coal Corporation, Ltd. (Dosco), which controls the Wabana ore and operates the mines through Dominion Wabana Ore, Ltd., a subsidiary. Upon completion of the program 2 years later the output rose to about 2,800,000 tons annually, as against the previous maximum of 1,850,000 tons. Incidentally, working underwater is nothing unusual with that company, which is mining coal in Nova Scotia at points nearly 4 miles off-shore and 2000 feet below sea level. In fact, it enjoys the distinction of being the leading producer of submarine coal.

The carrier is believed to exceed any other mine conveyor in both length and steepness of slope and can handle ore at the rate of 1000 tons an hour. The 36-inch-wide belt, furnished by the Goodyear Tire & Rubber Company of Canada, Ltd., travels at a speed of 575 feet per minute, bringing the material up the 12,500-foot, 8-degree gradient in ten flights—two of approximately 1450 feet each and eight of 1230 feet. The driving and supporting equipment was provided by Stephens-Adamson Manufacturing Company which, together with Goodyear, designed the system. The latter includes three underground screening, crushing and loading units and replaced four electrically operated hoists installed in a like number of slopes and handling skips of from 4 to 20 cubic yards each. Even with an average load of 24 tons and hoisting speeds of as much as 2850 feet per minute the method constituted a bottleneck at the prevailing rate of production.

According to geologists, Wabana ore is in rocks of sedimentary origin that were deposited on the floor of what is now known as Conception Bay millions of years ago. Through chemical action, the iron was leached from rock formations on land and carried in solution by streams feeding the shallow sea. That occurred at twelve or more intervals throughout the ages, leaving that many layers of iron-enriched sediment separated by strata of sandstones and shales relatively barren of ferrous minerals and denoting periods of erosion at elevations where there were no concentrations of iron.

Only three of the twelve ore beds are of minable thickness. The lower, or



PHOTO, MACLEOD-GILBERT A. MILNE & CO.

DELIVERING ORE TO SHIPS

A 2-mile enclosed belt conveyor (left) transports sized and cleaned ore from the minehead across the island to twin loading piers on the south shore. At the delivery end, a stacker (center) drops the ore into a 75,000-ton pocket in the side of the cliff. From the pocket it is carried to the ship by two bucket-type conveyors (bottom). The inclined conveyor can deliver 50 tons a minute and the horizontal one 70 tons, giving them a combined capacity of 7200 tons an hour.

"Dominion," and the middle, or "Scotia," are separated by 240-feet of sediments and weakly enriched ore seams, while the middle and topmost strata are roughly 58 feet apart. The Dominion varies in thickness from 5 to 30 feet, and the upper two beds have workable ore from 5 to 13 feet thick. Earth movements subsequent to the formation of the deposits not only tilted them but also caused faulting, thus considerably disjointing individual beds. These vertical displacements have complicated mining and added to the cost both of development and extraction.

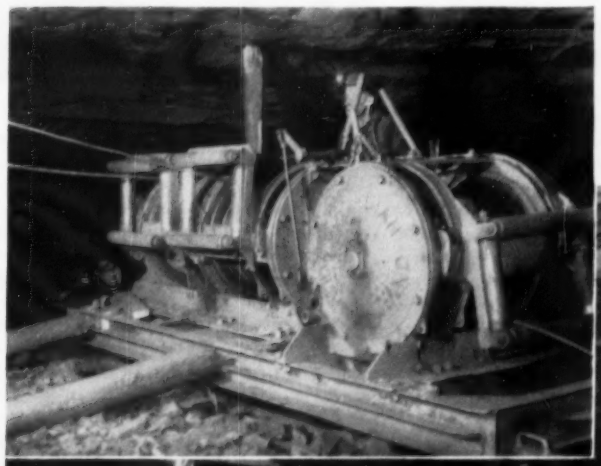
Wabana iron ore is distinguished by a physical characteristic that gives it certain advantages in mining, handling and smelting. Because of two major fault systems in the mineralized area, the deposits have two inherent directions of jointing that manifest themselves when the mineral is brought down by blasting. The result is a pile of rhomboid-shaped chunks that are for the most part a little larger than bricks. This uniformity facilitates handling the ore now as it did when fishermen used it as a ballast.

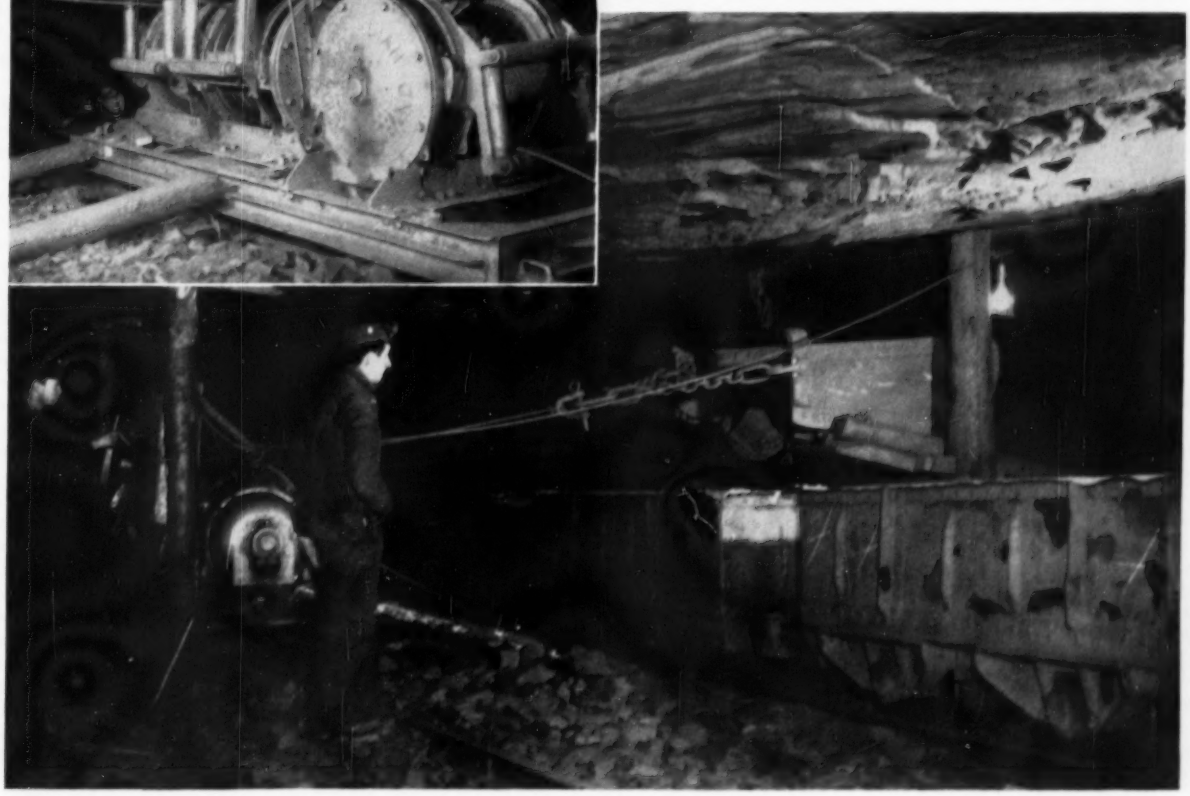
Subsequently crushed to smaller sizes and reduced somewhat by normal attrition, the ore arrives at Sydney in the form of a relatively uniform and coarse blast-furnace feed that is to the steelman's liking because it promotes smooth operation and a minimum of flue-dust losses. Wabana iron is low in most elements that are detrimental to steelmaking, and by blending ores from different sections of the mine the grade of each boatload is easily maintained, specifications calling for more than 50-percent iron and less than 12-percent silica.

Large subterranean ore deposits are generally explored and defined from the surface by means of core or churn drills. This method, however, cannot be used at Wabana, and for that reason it has never been possible to delimit the reserves. But geologists who have made independent studies there in recent years place the deposits among the world's foremost sources of iron ore. All who have examined the region are of the opinion that there may be additional reserves beyond the boundaries of the surveyed area.

The questions that naturally come to mind when submarine mining is mentioned are roof support, water disposal and ventilation. Oddly enough, there is no infiltration of sea water into the workings, and the small amount of freshwater seepage is easily handled by a few pumps. Little if any noxious gas has been encountered, and three-down-draft fans, each with a capacity of 100,000 cfm, provide the men in the three main mining sections with a constant supply of fresh air and clear the headings of powder smoke and fumes following blasting.

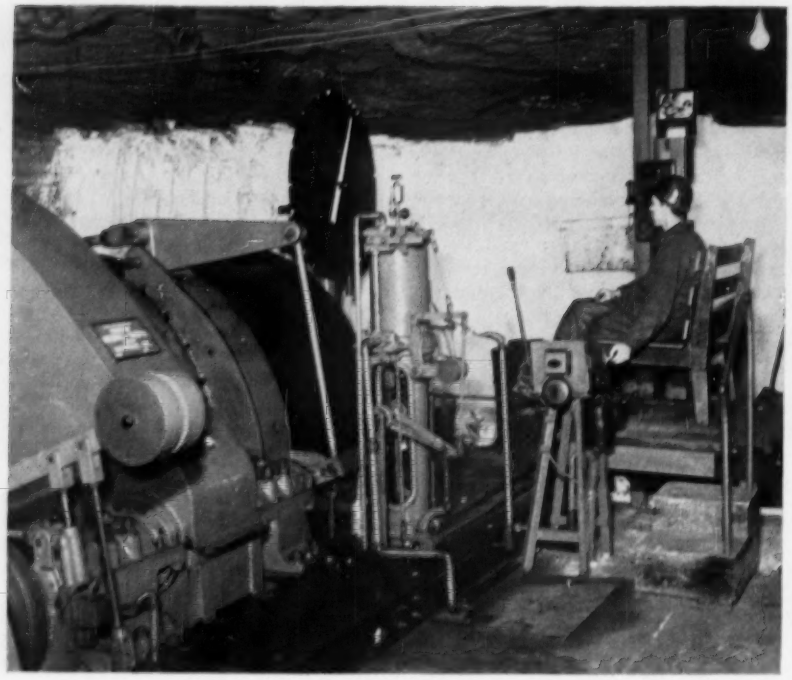
It was accepted during the early stages of the underwater operations that a minimum cover of 200 feet should remain between the workings and the sea bottom. The room-and-pillar method of mining is used because it affords strong and regularly spaced roof support. The rooms are 20 to 25 feet wide and from 5 to 14 feet high, depending on the thickness of the seams; crosscuts, driven normal to the rooms, are 20 feet wide and vary similarly in height. The proportion of ore mined to that remaining in pillars ranges from 50 to 60 percent, according to the thickness of the cover.





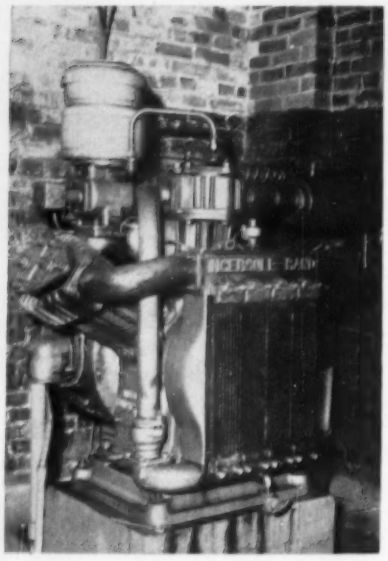
LOADING CAR WITH SLUSHER HOIST

An Ingersoll-Rand 50-hp electric hoist (below) pulling a drag scraper to an underground car-loading station. At the left is a close view of another 50-hp hoist that was developed especially for this mine. It has one drum (right end) at right angles to the two others. The third drum is used for spotting cars.



MINE HOIST

One of four Canadian Ingersoll-Rand hoists in the mine (left). Although ore is now brought out by conveyor, hoists are still used to transport men and materials. This unit is electrically operated and has a 72x54-inch drum. Below is a 25-hp Motorcompressor that supplies air for operating the brakes and clutches of the hoist that serves the main slope.



Only moderate timbering and other means of roof support have been required and are confined largely to the main slopes, principal traffic levels and to isolated areas where local faults have left shattered ground.

Column-mounted pneumatic drifters did the bulk of the drilling until recently, when drills on Jacklegs and "Drillmobiles"—self-propelled machines carrying two boom-mounted drifters—were adopted. Tungsten-carbide bits were put in service with this new equipment, a combination that has greatly speeded drilling operations. Some steel bits are still used, however. All holes are drilled on the day and evening shifts. The night crew does the blasting and loads the broken ore.

"Not a shovel in the mine" is the current slightly exaggerated boast of many mechanized workings, but that slogan does apply closely to Wabana. Hand mucking into 1.8-ton cars has given way to loading equipment of different types to meet the widely varying conditions encountered. There are mechanical muckers dumping into 5-ton cars, and rugged coal-loading models, discharging into 12-ton shuttle cars that transport the ore as much as 1000 feet to main haulageways, are in extensive use. Slusher or scraper hoists have found widespread application, and in some sections of the Dominion Bed where the height of the face permits—where the seam is more than 12 feet thick—special low-head ⅝-yard Thew Lorain electrically operated crawler shovels are utilized.

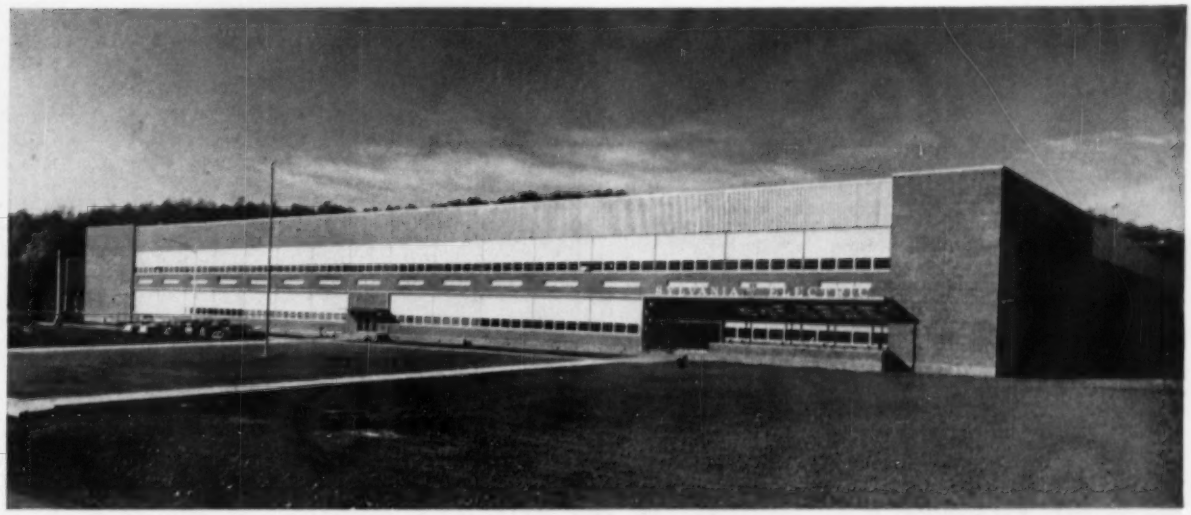
At the slushers and shovels and the shuttlecar transfer points the ore is dumped into mine cars which are pulled by hoists up inclines to gathering stations on the main haulage levels. There the cars are made up into trains of 24 each and moved by 13-ton Goodman trolley locomotives to one of three gathering stations near the foot of the conveyor slope. Trains are there run onto a rotary car tipple that dumps four cars at a time. The dumped ore passes over a grizzly and oversize goes through a jaw crusher set to produce a maximum lump of 10-inch size. Crushed ore falls into a pocket, where it joins the portion that passed through the grizzly. From the pocket, it is transported by belt to a storage pocket, from which it is fed to the main conveyor belt running to the surface. Each of the three stations loads ore onto the one main belt.

As mined, the ore contains about 5-percent waste rock, most of which is removed by hand picking when it reaches the surface. To facilitate this operation, the primary crushing underground is limited to reducing the ore no further than is necessary to obtain a size that can be handled efficiently by the belt transportation system. Following the picking, secondary crushing reduces the ore to a maximum size of minus 4-inch, after which it undergoes another picking. The picking and secondary crushing operations are carried on in what is known as the "deckhead building." At its top is a surge bin with a capacity of approximately 1000 tons. Its purpose is to smooth out the flow of ore and compensate for interruptions in either transportation from the mine or operation of the picking-crushing line.

From the deckhead building, sized and cleaned ore is transported by conveyor belt approximately 2 miles across the island to twin loading piers on the south shore. This carrier is the latest unit in the mechanization program and replaces the former system of hauling the ore in fourteen 22-ton diesel trucks. The conveyor discharges into a 75,000-ton loading pocket in the side of the cliff, from which vessels are loaded by two conveyors that have a combined capacity of 7200 tons an hour. They have loaded a 10,000-ton ship in 1½ hours. As many as nine vessels have been employed to transport the ore but a smaller number usually suffices.

The mine operates the year around, but the shipping season at that latitude is from May to December, inclusive. During the intervening months, the ore is stockpiled near the loading piers. Most of the ore goes to Dosco's steel plant at Sydney, but sizable amounts are delivered abroad.

Power for the completely electrified mine is supplied by Newfoundland Light & Power Company hydroelectric stations 30 miles away on the mainland and consumed at the rate of 21 million kilowatt-hours annually. Current is transmitted at 33,000 volts and carried across the 3½-mile bay section by submarine cable. Dominion Wabana Ore maintains a standby steam plant of sufficient capacity to continue high-level production in case of failure of the outside source of supply.



SYLVANIA'S "OUTSTANDING" LAMP FACTORY

Grace and symmetry of line are apparent in Sylvania's new St. Marys structure. "Factory Management and Maintenance" magazine, which annually presents its choice of the nation's ten most modern and efficient manufacturing establishments, included this one on its 1955 list. The boiler room is in the windowless section at the extreme left and adjacent to it is the pump room, which houses compressors and vacuum pumps. Sixteen elongated louvers, visible at the second-story level, are part of the gravity ventilation system for the production floor.

Lamp Factory In the Hills

Outstanding Sylvania Plant Has Efficient System for Handling Compressed Air and Other Gases

R. J. NEMMERS

IN the little city of St. Marys nestled in the rugged hills of northwestern Pennsylvania and far from any commonly recognized center of industry is one of the world's outstanding factories. Planned and engineered by the Sylvania Facilities Planning Office at Williamsport, Pa., in conjunction with the company's Lighting Division solely for the production of incandescent lamps, the facility has been commended widely for its efficient design and aesthetic architecture. One of ten operated by the Lighting Division of Sylvania Electric Products Inc., the St. Marys plant has been called the first really new and different lamp factory built in the last 20 years. In what is basically an assembly operation, it turns out a complete line of incandescent lamps from 15 to 300 watts, as well as indicator or panel lamps of the telephone-switchboard type.

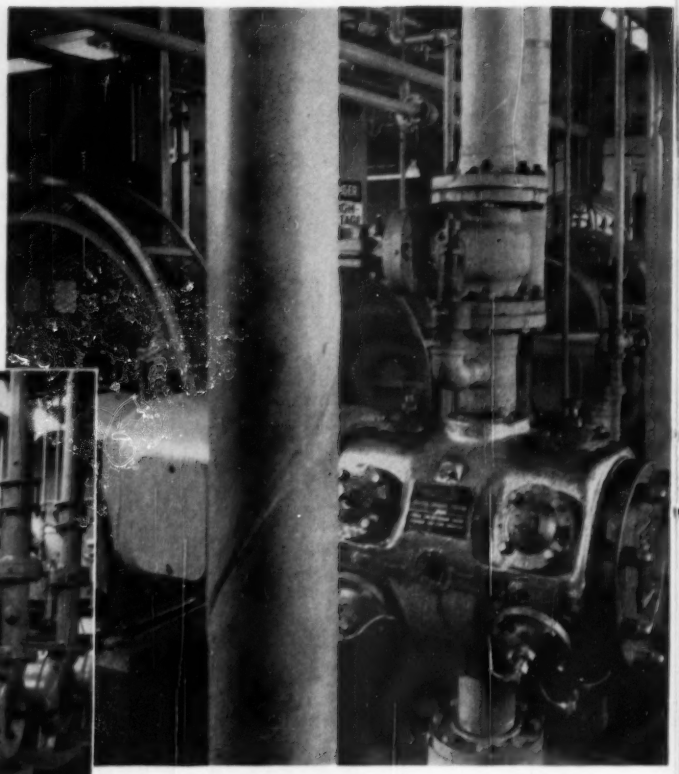
The structure is located just outside of the city limits and replaces old downtown facilities which had been in use since 1907. Of steel-frame and cinder-block construction, the building is faced on the front and sides with 4-inch brick and trimmed with pebble-finished aluminum siding and sashes. Extensive use of glass block also adds to the attractive exterior. Built on a sloping site, the plant is of split-level design to make the most of its location. The front section is two stories high: most of the production operations are done on the second floor while downstairs are offices, maintenance and service areas, the compressor and vacuum pump section, boiler room and a small production bay. The rear section —a warehouse—extends into the hill on the second story level.

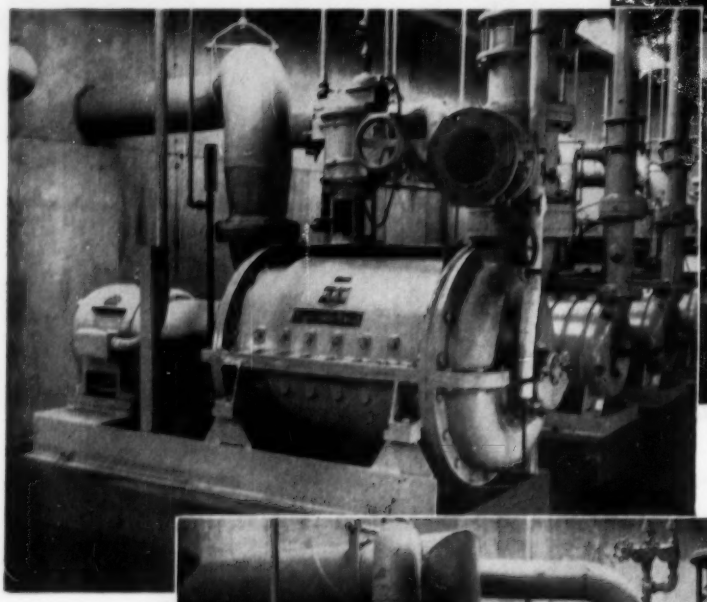
The total floor area is 170,000 square feet. The front section is 384 feet wide and 100 feet deep and the main (second story) production area has a clear span of that size—there are no columns or other obstructions. An interesting feature is the laminated all-wood production floor. Wood was chosen to make it easy to connect service lines (air, gas and electric) to production machines. All services are beneath the floor in a giant loop encompassing the entire production area. To hook up a machine—some of them require as many as 24 separate service lines—holes are bored in the floor and the feeder line tapped into the main supply. If it becomes necessary to reposition a unit, old holes can be plugged easily and others bored at the new machine site. The warehouse extends 283 feet back from the 2-story section. The rear wall has no brick facing and thus it will be relatively easy to remove the cinder blocks and extend the building if future conditions warrant.

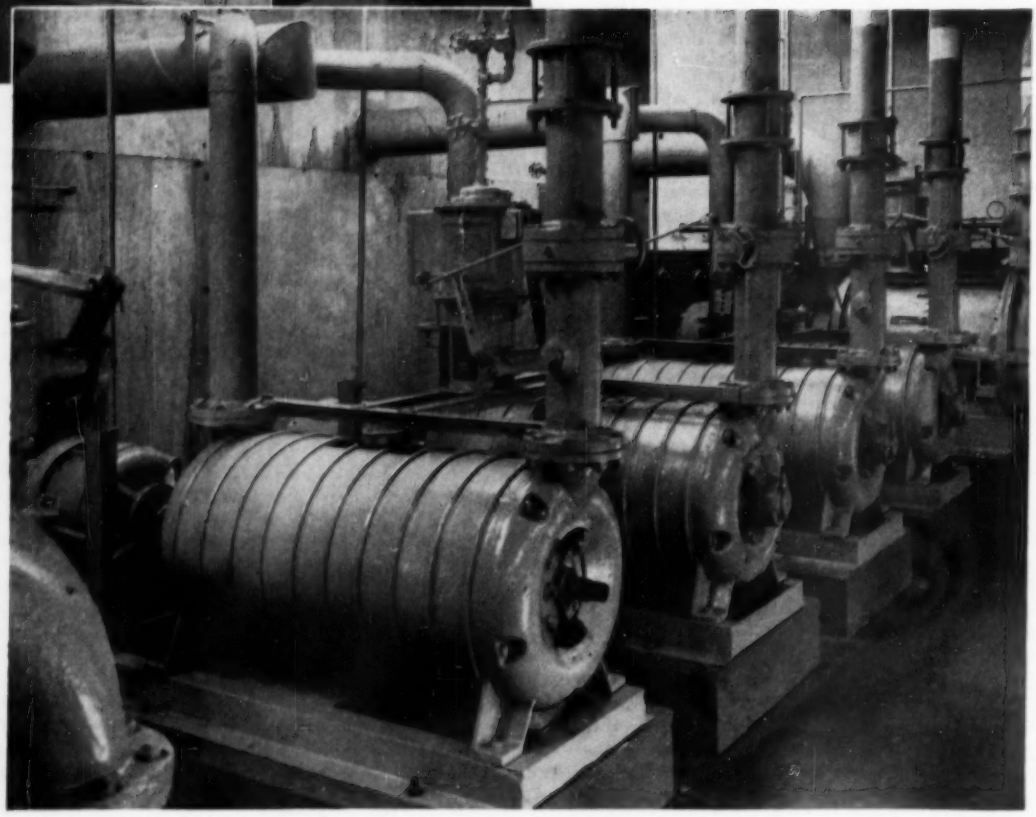
In operation for only 15 months (the facility was dedicated October 26, 1955) the million-dollar addition to the Sylvania network of plants has already proved itself worth the money and the 3 years of detailed planning that it represents. Plant manager Robert G. Morgan reports that materials handling costs are down 50 percent as compared with those at the old downtown plant, that production costs also have been cut and that product quality is improved. St. Marys was chosen as the site of the new structure because Sylvania had a record in the community of nearly a half century of successful employe relations and there was, of course, a well-trained labor

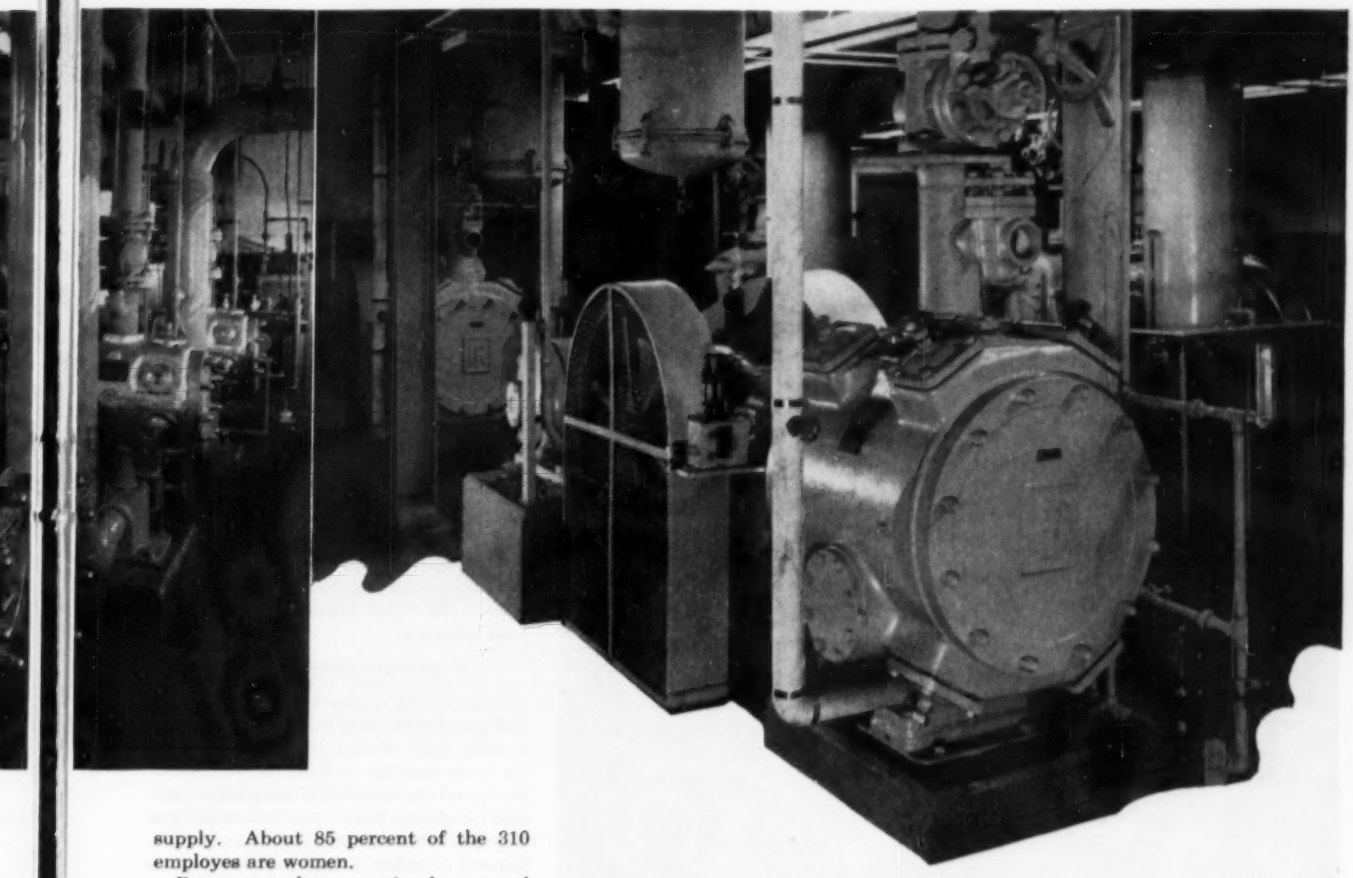
BLOWERS AND COMPRESSORS

Three Ingersoll-Rand nonlubricated compressors (right) furnish high-pressure (85-psi) air. In the foreground below is shown the I-R Class FN blower that supplies combustion air to the production machines. Nominally rated at 2000 cfm at 5-psi pressure, the unit actually delivers 2075 cfm at 4¼-psi pressure. Behind the plywood partition at the left are all of the plant's air filters. The bottom picture shows the four Ingersoll-Rand Class MM standby blowers that can supply either combustion or cooling air. This illustration also shows how the units are paired, with each pair drawing intake air from a common line from the filter. The bearing block on the outboard end of the blower in the foreground had been removed for servicing. In the background is another FN blower that supplies cooling air.









UTILITY VACUUM PUMPS

Two Ingersoll-Rand vacuum pumps that produce utility vacuum for operating suction lifts and performing other chores. They take suction at about 35 to 45 millimeters of mercury pressure absolute and are V-belt driven by 40-hp induction motors. Dollinger filters (top left) may be seen suspended from the intake line.

supply. About 85 percent of the 310 employes are women.

Because we have previously covered in detail the various uses for compressed air and gases in a Sylvania incandescent lamp factory (*Light by Sylvania*, July, 1956) we will devote this article to the machines and the system which supply air and other gases to production lines. The "pump room," as the compressor area is known, is modern in every respect and on a par with the efficient design of the rest of the facility.

BLOWERS AND COMPRESSORS

Compressed air is called by three different names corresponding to its use: "combustion air" is mixed with natural gas and burned in machines that make flares (that portion of a lamp on which the filament is mounted) and that seal flares to bulbs, etc; "cooling air" cools flares and lamps; and "utility" or plant air is used in pneumatic cylinders, presses and the like. An Ingersoll-Rand Motorblower (nominally rated at 2000 cfm and 5-psi delivery pressure) furnishes 2075 cfm of combustion air at a carefully controlled pressure of 68 ounces (4¼ pounds) per square inch. The unit is driven at 3550 rpm by a 75-hp motor.

Cooling air is supplied by two blowers designated as Numbers 1 and 2. Number 1 is a companion unit to the combustion air machine and has the same nominal and control-point pressures and capacities. Number 2 has a capacity of 1350 cfm and discharges at a pressure of 80 ounces (5 pounds) per square inch. Four I-R Motorblowers are on standby service. By properly manipulating the valves of an ingenious manifold arrangement, the latter machines can supply either combustion or cooling air. Each is nominally rated at 650-cfm delivery at 4½-psi pressure and is driven at 3550 rpm by a 25-hp motor.

Plant air at 85 psi is supplied by three Ingersoll-Rand Class ES, 9x9 inch, single-stage, non-lubricated compressors. The units are equipped with Powers automatic-cooling water controls and are V-belt driven by 40-hp induction motors. Compressed air from the machines first is aftercooled in I-R pipeline-type aftercoolers and then is transferred to an air receiver before entering the main service loop.

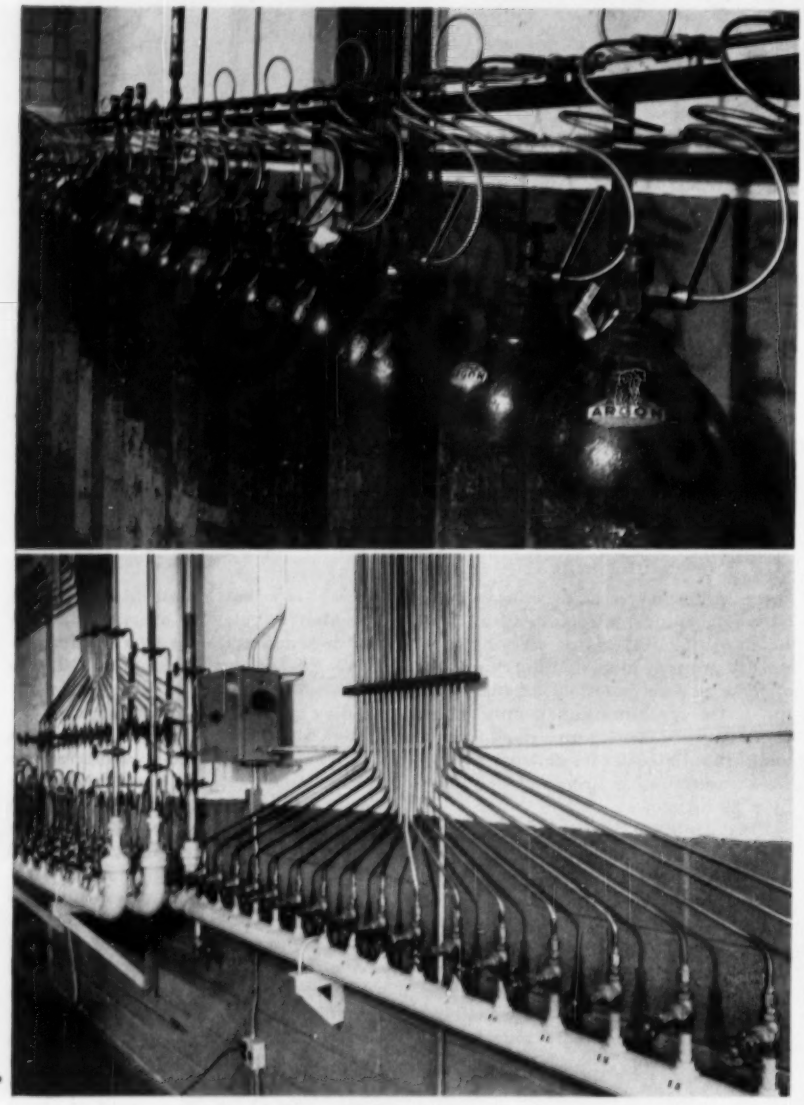
FILTER INSTALLATION

All blowers and compressors are protected from dust and dirt by modern air filters manufactured by Dollinger Corporation. There is one for each compressor, one for the combustion blower and one for each cooling-air blower. The four standby blowers are paired, each pair drawing intake air from a common filter. In the usual installation, filters are installed outside of the compressor building with an overhanging roof to protect them from rain and snow. As such a protrusion would have marred the simple building lines, the filters were placed inside and separated from the rest of the pump room by a floor-to-ceiling plywood partition. Louvers aligned with windows along the building front admit fresh, cool, clean air from outdoors to the filters, yet the beauty of the structure is preserved. The filters are located above the louvers to obtain more direct air flow, but are easily accessible from a catwalk running the length of the enclosure. The louvers have sufficient area to keep air velocities low and, as a consequence, the installation is extremely quiet. The filters are serviced at about 6-month intervals.

Four grades of vacuum are employed: three for process use—"rough," "B" and "C"—and one, "utility," for operating suction lifts and doing other mechan-

ical chores. Utility vacuum is produced by two Ingersoll-Rand Class ES-1 vacuum pumps taking suction at 35-45 millimeters of mercury (mm Hg) pressure absolute. A Dollinger vacuum filter is installed in each intake line. Each machine discharges to atmosphere through a 12½-foot Maxim silencer. Eight-inch discharge lines run to the roof of the building. Oil diffusion pumps (two for "rough," one for "B" and three for "C" vacuum, plus one standby unit) take care of process vacuum requirements. The diffusion pumps operate in the range from about 1.8 to 2.5 mm Hg, abs.

Three different process gases—oxygen, nitrogen and argon—are used in the manufacturing operations. All are supplied by Air Reduction Company from a plant near Butler, Pa., and the same concern owns and operates the tank farm where they are stored at the Sylvania factory. Liquid oxygen equivalent to 150,000 cubic feet of gas is stored in one vessel and piped directly to the production floor. A tank of the same size holds liquid nitrogen. Argon of three degrees of purity is available. Most used is an 88-percent-argon, 12-percent-nitrogen mixture, which is supplied by a tank trailer of 38,000-cubic-foot capacity parked at the farm. While a fresh tank is being substituted for an empty one, a reserve bank of small cylinders supplies the gas. The second and third grades, respectively 95- and 99.6-percent pure, are drawn from banks of cylinders in the boiler and pump rooms. Eventually it is planned to have only 99.6-percent argon delivered and to mix it at the plant with sufficient nitrogen to produce the grades desired. All argon mixtures are piped to a manifold which distributes the gases as required to any of eighteen different lines feeding the production machines.



ARGON SUPPLY

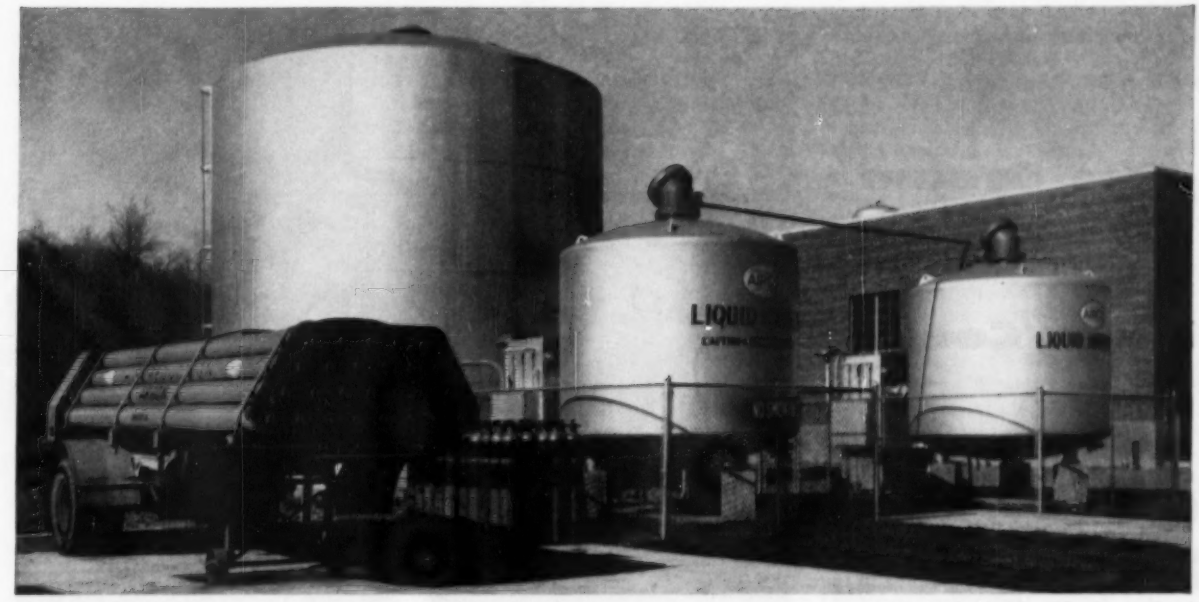
The bank of cylinders (top) contains 95-percent-pure argon, which is piped to the manifold shown in the lower view. Any one of three grades of argon (88-, 95- and 99.6-percent pure) can be fed to any or all of eighteen different lines. The valves shown at the manifold are Lunkenheimer units designed especially for this service.

Natural gas mixed with combustion air, as we have said, is used for making flares and sealing flares to bulbs. It also is used as boiler fuel for heating the plant. Gas reaches the factory at 15-psi pressure. For the first purpose it is reduced to 8 psi and then mixed with a small quantity of sulphur dioxide, which is deposited on flares and bulbs when they are heated and thus aids production by serving as a glass lubricant. Before going to the lamp-making machines, the mixture is reduced to 20 ounces (1¼ pounds) pressure per square inch. The gas for the boiler burners is reduced to 3-psi pressure.

AIR AND GAS CONTROL SYSTEMS

The plant's under-floor air, vacuum and gas distribution network consists of a main loop of two 10-inch lines—one for lamp cooling air from blower Number 2 and one supplying combustion air; and two 8-inch lines—one for natural gas and the other carrying cooling air from blower Number 1 and six other lines running down the middle of the loop. There is a 2-inch oxygen line; a 4-inch pipe for high-pressure air; a 6-inch utility vacuum line; another, also 6 inches in diameter, for "B" vacuum; an 8-inch line for "rough" vacuum; and a 10-inch pipe for "C" grade vacuum.

All lines are, roughly, double the size required for the service they now perform. This not only provides reserve capacity for future expansion but also utilizes the pipes as storage or surge tanks to smooth out pressure fluctuations. Unvarying gas pressure is of great importance in obtaining consistently high-quality production as well as making sure that a steady output is maintained. To help in the task, a control system was developed jointly by the company's engineers and specialists from The Bristol Company. Center of the system is a 10-position board, on each panel of which are provisions for two recording instruments. Eighteen are now in service and measure and record "rough," utility and "C" vacuum pressures; combustion air and gas pressures; pressures delivered by cooling-air blowers 1 and 2; pressures of oxygen, of all three grades of argon and of nitrogen as well as the amounts of those gases being used; and the Btu content of the combustion gas. Two others, soon to be installed, will measure and record plant air pressure and "B" vacuum pressure. Volume

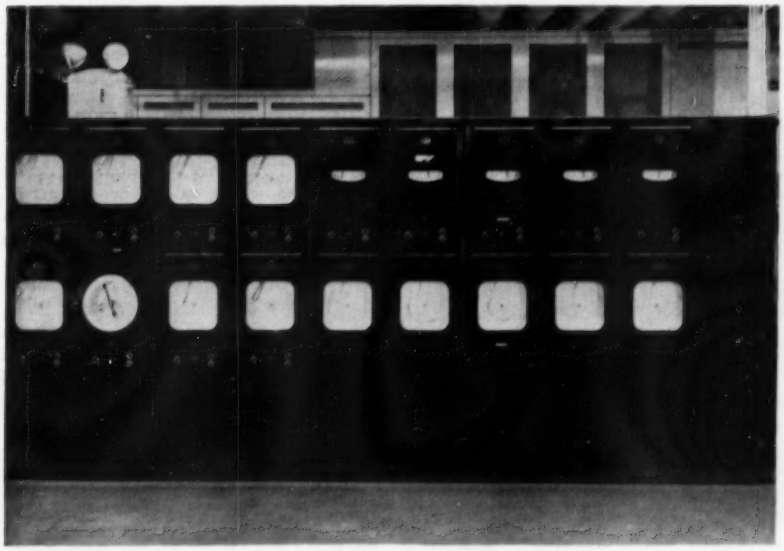


TANK FARM

Air Reduction Company owns and operates the tank farm that supplies process gases to the plant. The two tanks in the right foreground contain liquid oxygen and liquid nitrogen. The parked Airco tank trailer at the left contains argon of 88-percent purity, as do the cylinders at its right, which are drawn upon while a changeover to a full trailer is being made. A 150,000-gallon water supply for fire control is stored in the other tank.

measurements for process gases are recorded in terms of cubic feet per hour.

But merely recording a condition is not enough to assure the degree of quality control needed. Each recorder has adjustable maximum and minimum control points. If line pressure gets outside the preset limits, an elaborate alarm system is tripped. Warnings are both visible and audible. Work on the production floor can be stopped (to prevent producing faulty lamps) as soon as warning signals are actuated. When the trouble is cleared, the system on the production floor clears and work may be resumed. Another set of signals, located at the control board, acts somewhat differently. The audible signal shuts off as soon as the fault is corrected; however, the visual warning—a red light below the recorder—remains on until the alarm is manually reset. This means that the engineer can quickly locate the trouble without painstaking examination of the charts and lose no time in correcting it; and also, that he can tell what was wrong if it were only an automatically corrected, momentary fault.



CONTROL PANEL

Here is the elaborate control system that maintains proper gas pressures and also records them along with other vital data. All charts are of 24-hour recording capacity and are changed at the start of each day. The spotlights on top of the board at the left are battery-powered and go on automatically in the event of a power failure. One is aimed at the door, the other at the air gauge, receivers, etc.

VENTILATION SYSTEM

Production machines generate a great amount of heat and the problem of disposing of it to assure comfortable working conditions received a great deal of attention from the designers. The problem was complicated by the fact that almost no air movement can be tolerated around some of the machines—the slightest draft would adversely affect the gas flames used for flaring and sealing. Under these conditions powered ventilating equipment is not permissible and the necessary complete air change each minute has to be obtained by natural or gravity ventilation. The solution was to install sixteen long aluminum louvers in the front wall near the floor and two rows of continuous roof vents. Immediately above each of the sixteen major production units (a production unit is made up of several machines and is a complete assembly line in itself) are low-velocity exhaust fans discharging just below the roof vents. They are the only powered fans on the production floor,

The Dream of Peter Cooper

PROJECTED NEW BUILDING

Located on Astor Place, across the street from its 100-year-old predecessor, the ultra-modern glass-and-steel structure will include a tiny campus with trees and a patch of grass.

CITIZENS of New York City, in 1859, gazed in admiration at a brand-new building at Astor Place. In many respects it was years ahead of its time. It was the first building in the country to use rolled-iron structural beams—the forerunner of modern skyscraper construction. It had a lecture hall with an air-conditioning system. There was even a shaft for an elevator—despite the fact that no one up to then had developed a passenger elevator.

The name of the institution was typical of its era, sonorous and detailed: The Cooper Union for the Advancement of Science and Art. The modernistic features of the building, as well as the revolutionary educational idea behind it were typical of the man who had built it—Peter Cooper, iron master, glue manufacturer and the inventor of the "Tom Thumb" steam engine.

When Peter Cooper finished building the Cooper Union, he was 68 years old. At the age of 17, he had been an apprentice, working for the princely salary of $25 a year. He had no formal education, and as he matured, both as a self-taught scholar and a highly successful business man, he dreamed of providing his country with an educational institution that would be open to anyone, free of tuition charges, combining education in science and art in what he called a "union" of the two great concepts.

While there was much talk of public education in the pre-Civil War period, this was the first privately endowed institution in America to give free education and to maintain a free library where anyone can go to read. Peter Cooper's dream had begun to live. The institution has now carried it on for almost a hundred years, but the building itself can make not the slightest claim to modernity. While the Cooper Union approach and philosophy are still fresh, its physical housing has been covered with the dust of yesterday.

But only for the moment. Peter Cooper's successors, the trustees of the school, have decided that the founder would look upon the hundredth birthday of the college—which will come in 1959—as the time at which the institution should be given a new lease on modernity. They have decided, also, that he would not wait until 1959 to begin a new building. Rather, they feel, he would begin right now, and have the new building ready for occupancy in 1959.

Their plan is to erect an 8-story engineering building on a site right across the street from the old building. Faced with gleaming glass, of steel and concrete construction, it will consist of five wings, the south one raised two stories above the ground to provide a broad passageway leading to a landscaped park. The money for the development will come from private sources.

When this project is completed, citizens of New York City will likely gaze upon it with as much admiration as their predecessors of 1859 gazed upon Peter Cooper's original foundation building. For the Astor Place neighborhood, hard by the Bowery, once a fashionable center of the city's activities, has become sadly run-down. Steps toward its rehabilitation have been taken recently. The old Third Avenue elevated railway that once ran alongside the original building has been torn down. Third Avenue is being widened and beautified with trees and lights, and the shabby areas thus newly exposed are undergoing some hesitant touches of rehabilitation at the hands of their owners.

The new Cooper Union building will continue and strengthen the dream of Peter Cooper: the best possible education for anyone who wants it and can qualify for it, unifying the concepts of science and art, with tuition free. Over the years, the school has produced thousands of thoroughly educated engineers and artists whose talents would otherwise have been lost to the nation. On the artistic side, 44 graduates have won either Fulbright Scholarships or the coveted Prix de Rome. And on the engineering side, the graduates of the school, in proportion to their numbers, have been rated third in a field of 19 technical schools throughout the nation—a record surpassed only by Massachusetts Institute of Technology and California Institute of Technology.

How does a small college like Cooper Union (its enrollment is less than 1400) produce such results? The answer is simple: because the school is tuition-free, only an exceptional student can get in. And because it has never received a cent of money from the national, state or city governments, it is free to set its own high curricular standards and enforce them. In short, students have to be good to

enter and must get even better before they can graduate.

Because the school has facilities for no more than a tenth or a twelfth of qualified applicants, it selects students on the basis of stiff competitive examinations that weed out all but the top 5 or 10 percent. For example, half of this year's entering class of some 100 day-school engineering students are in the top 1 percent of all high school graduates throughout the nation, on the basis of college board examinations. All of them are in the top 7 percent.

Under the watchful eye of President Edwin Sharp Burdell, who has been described as an "engineer-philosopher" and who was the first dean of the humanities at M.I.T., these young scientists and the art students who are their classmates, will receive a thorough training in their specialties. But they will also receive a fine basic training in the things which are not their specialties. Dr. Burdell insists that every engineer study the humanities throughout each of his four years in the college and that each of the artists acquire a grasp of the practical applications of art as well as its theory. He interprets Peter Cooper's idea of the "union" of science and art as being just that—not only a prohibition against producing specialists who can't think and make decisions, but a positive command to produce graduates who know their specialties and have a deep appreciation of all other fields of learning as well.

This unusual school, founded by an unusual man, will carry out in its new, twentieth-century garb, the many instructions that Cooper left behind him in his famous Letter Accompanying the Deed of Trust. He specified that he wanted the students to share in the administration of the school and a student government has existed from the start. He specified that race, creed or color would never be used as qualifications for entrance and there has been almost 100 years of non-discriminatory education. He provided the first free public library in New York within the school, still being used by the public; he provided that it have a museum which has since become one of the most famous in America, containing some 70,000 objects specifically illustrating the decorative arts. The Great Hall of the building, he directed, was to be open for free lectures to all of the public, and this contribution to the field of adult education —today recognized by experts as one of the most important of all educational fields—has been cultivated for 97 years. Twelve American presidents—Abraham Lincoln was the first—have spoken in the Great Hall. The Cooper Union Forum, free to all, has become a nationally-known institution. Many of the nation's best-known speakers and thinkers have lectured there, and today Forum sessions are being aired by the National Association of Educational Broadcasters in 22 states, including California.

Another aid to adult education was Cooper's specification that there should be night courses, as well as day courses, so that working people could learn while they were earning. Many famous engineers of today are graduates of those night courses.

The school has produced graduates such as Augustus St. Gaudens, the sculptor, and Michael Pupin, the inventor. But apart from its graduates, its influence has been felt by many other Americans. Supreme Court Justice Felix Frankfurter who, as a boy, spent hours in the reading room and attending Forum lectures, has recalled Cooper Union as being "the place that first stretched my mind."

Two subway kiosks stand at Astor Place and many students think of them as doors to Cooper Union. It is truly a subway college, yet it has one of the biggest "country campuses" extant. On a 1000-acre tract in northern New Jersey, given outright by a descendant of Peter Cooper, the college has established the Green Engineering Camp. Among its wooded hills, engineers practice surveying and artists do landscape paintings. Besides, the camp offers students free week-end recreation away from the city streets.

ONCE NATION'S FINEST

Lithograph (left) of Cooper Union's Foundation Building as it appeared in 1860. The building was then hailed as the most modern in the country. Its rolled-iron beams made it the forerunner of the skyscraper. At the left was The Bible House and at the right Thompkins' Market. The other picture shows the building as it is today—no longer modern but a historical landmark. At the lower right is the Hewitt Building, added to the college in 1912.

POWER TOOLS VERSUS HAND TOOLS

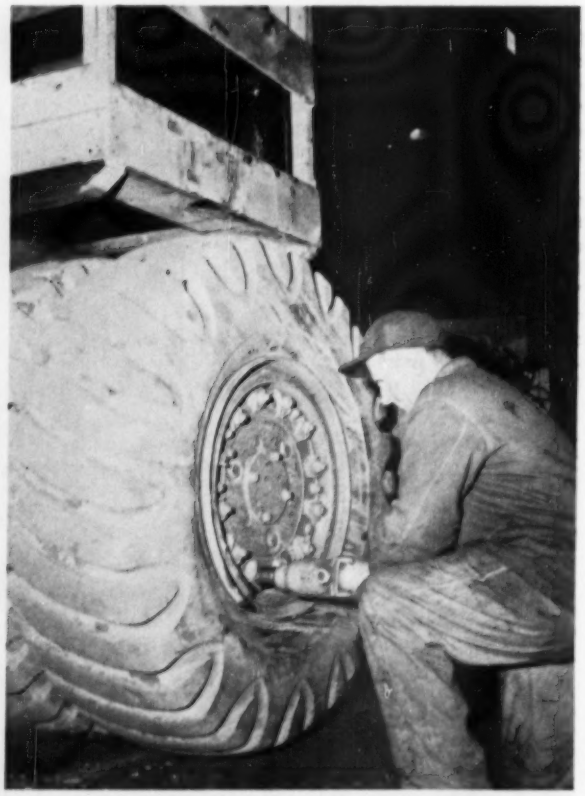
The labor-saving advantages of a pneumatic tire tool are clearly illustrated in these pictures. A light taped to the sledge hammer in the picture at the left shows the back-breaking labor requisite to breaking a bead—separating the tire from its wheel. A similar light mounted on an Ingersoll-Rand Size 8000 tire tool demonstrates the comparative ease associated with the latter method. Bruised, skinned and broken knuckles are frequent occurences when maintenance men must use hand tools; power tools do the job more safely, besides doing it faster.

Compressed Air Aids Tire Maintenance

As these pictures show, air-powered tools can take over much of the hard work associated with maintaining tires, particularly larger ones.

TUBELESS TIRE CHANGING

The rig shown in this operation is an air-operated table used for tire maintenance and designed for tire shops having a great deal of tubeless tire work. Known as the Lee Tubeless Truck Tire Changer, the device takes the hard work out of the job by using pneumatic cylinders for muscles. It works equally well on either plain disk or standard rims and uses air at 125 psi. Either hand- or air-powered bead breakers can be used.



AIR-POWERED WHEEL CHANGING

"The bigger they are, the harder they come off" is a general rule of thumb in tire maintenance. In this illustration an Ingersoll-Rand Size 334 Impactool is being used to run-off twelve mud-caked nuts on the big dual wheels of a 35-ton Euclid dump truck. Time studies of the operation showed that use of pneumatic tools halved the time required to remove the two tires and replace them with new ones.

MOBILE FLEET SERVICE

According to the American Trucking Association, 26.3 percent of all road breakdowns of trucks are due to tire troubles—either blowouts such as the one shown in the photo at the left or simply "flats" caused by punctures. Because downtime on the road is extremely expensive, most trucking companies are taking steps to reduce it, both through preventive maintenance and by speeding the repair of trucks which do break down. The fleet service truck illustrated in these two pictures is one way to help the latter cause. Equipped with an Ingersoll-Rand Model FGT compressor and an assortment of pneumatic tools including I-R Size 334, 310 and 304 Impactools and a Size 8000 tire tool, the unit can handle all tire troubles as well as most other road breakdowns. The tire tool is shown being used to "break the bead" of a flat tire preparatory to removing it from the wheel.

Thai Official Visits Texas Irrigation System

VICHARN RATAWUD, governor of the province of Lampang in Northern Thailand, recently visited the pumping facilities of the Lower Neches Valley Authority in the Beaumont, Tex., area that move irrigation water to 400 square miles of the finest rice fields in the United States. He was given an opportunity to compare this modern system, powered by natural gas, with the more meager equipment available in his own country, which is almost entirely dependent on rice culture.

Co-hosts during a tour of pumping stations and canals were Fred W. Sultan, Jr., of Houston and George D. Forristall of Beaumont. They represented Ingersoll-Rand Company, which manufactured the pumps and engines used there. Representatives of the Gas Appliance Manufacturers Association and the irrigation authority joined in the tour.

To put water on the rice land, two man-made rivers feed a network of 280 miles of canals. The system was started in 1898 and expanded and modernized by the Lower Neches Valley Authority, which was created in 1933. New pumping units having an aggregate capacity of 4000 hp were installed in 1955. The district and its facilities were described in our January 1956 issue.

Governor Ratawud, 52-year-old leader of some 400,000 Thais, said that his country is interested in the eventual purchase of the type of rice irrigation machinery he saw to replace the inadequate, portable equipment being used in Thailand. In his land, he said, "rice farmers must and do work now as they have for centuries past. Virtually all of the planting and harvesting is done by hand and with little mechanical help. We have a few portable engine-pump units that are moved about from field to field in the peak production areas."

The leadership of Thailand, he explained, is determined to raise the basic living standards of its people and plans are being made for other Thai leaders to visit America to study this nation's agricultural and industrial program. His country has some oil production, but its fuel resources are largely undeveloped.

COMMON INTEREST IN RICE

Rice is a thirsty crop. To learn how Texans irrigate vast areas producing bountiful crops of the grain, Vicharn Ratawud (left), governor of Lampang Province, Thailand, inspected facilities of the Lower Neches Valley Authority near Beaumont. Here Fred W. Sultan, Jr., manager of Ingersoll-Rand Company's Houston sales office, explains the operation of one of the 1320-hp gas engines built by his firm. It powers the pump partially shown at the right.

THE MILK THAT DIDN'T SPOIL

The Story of Gail Borden and His Vacuum Pan

ALLEN S. PARK

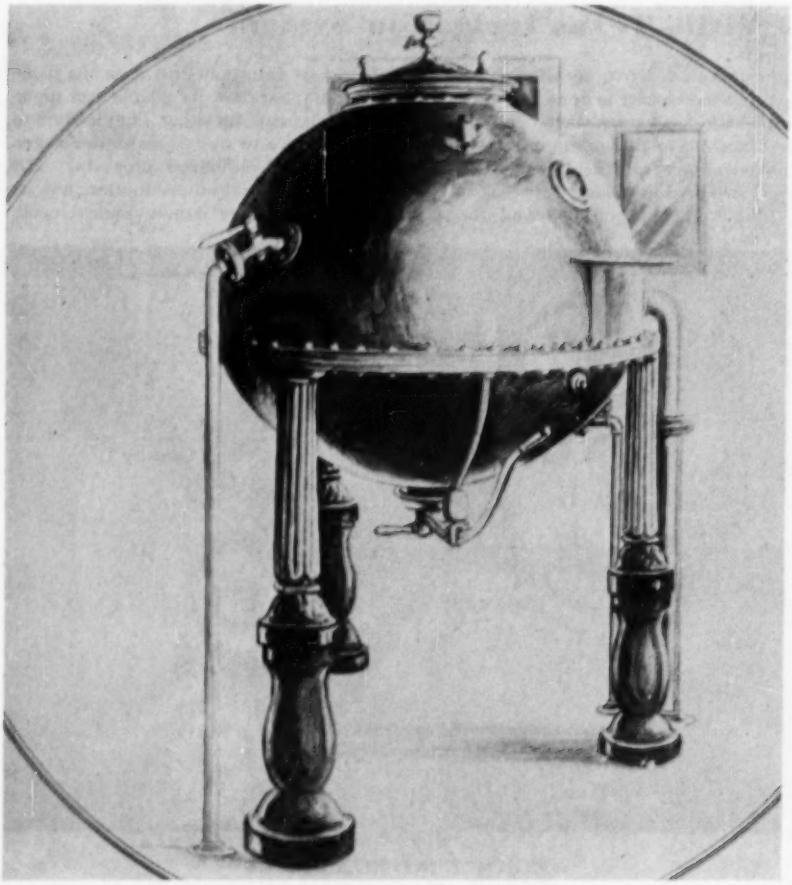
THE BORDEN Company, worldwide processor and distributor of dairy and food products, was founded 100 years ago. It started out as a manufacturer of condensed milk, a product that materially changed the pattern of American life and markedly reduced infant mortality. This new type of milk came from an epochal invention by Gail Borden, who has remained relatively little known by the masses he benefited.

The story of Borden is a tale of dogged persistence by a man who repeatedly brushed aside an avalanche of adversities that would soon have buried one of lesser courage. Others before him had condensed milk but he was the first to make it palatable and safe from contamination and consequently of commercial importance. The crux of his process was boiling the milk under reduced pressure in a "vacuum pan" that he came across during a visit to a religious colony in upstate New York.

Borden's achievement was the outgrowth of a fervent desire to improve the health of his fellow beings. He perhaps acquired this almost fanatical regard for humanity because he had had to overcome frailness in his youth. Born in Norwich, N.Y., November 9, 1801, he accompanied his parents to Kentucky when he was 14 and then later to Indiana. In the latter state, at the age of 20, he was the official surveyor of Jefferson County. Within a few months, however, he sought the warmer climate of Amite County, Mississippi, to try to get rid of a hacking cough that had been bothering him for several years. To support himself in the South, he taught school in winter and did surveying in the summer. Six years after arriving there, his health restored, he married.

GAIL BORDEN

Founder of The Borden Company, which is starting its second century of business. The original product, condensed milk, has grown to 800 items, with sales approximating three-fourths of a million dollars annually.



ORIGINAL VACUUM PAN

Drawing of the vessel owned by the Shaker community at New Lebanon, N. Y., and borrowed by Borden for his first experiments in condensing milk. The "pan" is now in the Smithsonian Institution in Washington, D. C.

In 1829 he migrated to Texas and settled on a homestead of 4428 acres—a Spanish league—intending to become a farmer. Instead, he was soon called upon by Stephen Austin, the founder of Texas, to help in the struggle for Mexican statehood and, later, independence. He became the publisher of a newspaper that served as an important recruiting medium. Eventually the Mexicans captured and burned his shop and dumped his presses in a river, but he continued to serve, under Sam Houston, until Texas had won its freedom.

President Houston appointed Borden Collector of the Port of Galveston, but the pay wouldn't support his wife and six children and he sought to capitalize on an idea he had long held that food could be preserved and made safe for storage by condensation. Aside from the ulterior motive he, an intensely religious man, believed that anything he might do to prolong human lives would be a service to God. The death of his wife and a 4-year-old son from yellow fever caused him to redouble his efforts. Two years later another son died.

Experimenting first with meat, he boiled 110 pounds of beef down to ten, dehydrating and condensing it to an extract. He kneaded this with flour and baked biscuits. He sold 600 pounds of them to goldseekers en route to Calif-

A PROPITIOUS CONVERSATION

Following years of frustration and at a time when his outlook was exceedingly bleak, Borden chanced to share a seat with Jeremiah Milbank, a well-to-do merchant, during a train ride from Connecticut to New York. Milbank thought the idea of condensing milk a sound one and gave Borden the financial backing that brought success.

ornia and Dr. Elisha Kane, an Arctic explorer, took some on one of his expeditions. Shortly afterward Borden and a brother, Tom, built a plant in Galveston to produce the biscuits.

In 1851 he displayed the product at the International Exhibition in London and was awarded a gold medal and also honorary membership in the London Society of Arts. Flushed by this taste of success, Borden envisioned adoption of his concentrated food by armies, navies, merchant ships, hospitals and explorers. But this was not to be and he was, in fact, to endure years of hardship and disappointment before winning financial success and lasting fame with his condensed milk.

His interest was temporarily diverted from beef extract to milk during his trip home from abroad. Aboard the slow sailing ship were two sick cows and when immigrant babies were fed their milk they also became ill. The crying of the infants and the lowing of the animals disturbed and distressed Borden and he made up his mind to find a way to preserve milk for use under such conditions. In New York he tried to sell his biscuits to steamship lines and hospitals and even went into their galleys and kitchens to cook meals that included his product. His potential customers were indifferent and sales were few. In Washington he spent months trying to interest the Army and Navy, but they wouldn't even give the biscuits a trial.

Meanwhile the factory in Texas was making and stockpiling biscuits, most of which were never sold. The outcome was a loss that has been estimated at between $60,000 and $100,000—an enormous sum at the time. Unmindful of the unfavorable tide of affairs, Borden, practically broke and living in a basement room in Brooklyn, was trying to condense milk by boiling off the water in an open pan. He reduced a gallon to a quart and obtained a dark-colored substance that had a scorched taste. An idea of his indomitable spirit may be gained from letters he wrote during this period saying that his firm trust in God was all that sustained him, but adding: "Do not infer that I believe I shall not succeed."

He had sent his four motherless children to a Shaker religious colony at Lebanon, N.Y., to be cared for and while visiting them there one day he found the key to his ultimate success. He observed the Shakers boiling down fruit preserves in a "vacuum pan," a spherical vessel from which most of the air had been exhausted. This is a common tool of many processing industries today but was then virtually unknown. Permitted to use the pan for a few hours, Borden was intrigued to find that milk would boil in it at 136°F, compared with 212° in open air. The product was palatable and not discolored. To make this vacuum pan work, the Shakers must have employed some sort of vacuum pump or air pump, as it was formerly known, with which to withdraw air from the vessel. However, nothing is known of it as Borden historians have found no mention of it in the archives.

Returning to New York, Borden pondered the possibilities of applying such equipment to his problem. In the spring of 1853 he visited John Benson, a coppersmith on Water Street in Brooklyn and prevailed upon him to make a vacuum pan suitable for experimentation. Borden always referred to his process as condensing "in vacuo," and it was as such that he applied for a patent on it. The patent office declared, however, that it saw nothing worth-while or unique about vacuum condensing. For 3 years Borden continued experimenting and besieging the patent office, pointing out that the vacuum feature was the heart of his idea. Finally, on August 19, 1856, he received his patent.

Even then the road ahead was still rocky. Borden opened his first condensery at Wolcottville—now Torrington—Conn., and personally sold from door to door in New York the 20 to 30 quarts of milk condensate the tiny plant produced each day. But people didn't like the milk's taste and customers were hard to hold. The Connecticut farmers who had been selling Borden raw milk on credit refused to supply him any longer.

Borden was soon out of business. Returning to Texas on borrowed train fare, he raised a limited amount of money and

GOING TO THE PEOPLE

To introduce his product Gail Borden sold it on the streets of New York during the winter of 1856-57. The demand for it was not as great as this sketch implies. It was, in fact, not sufficient to keep the condensery in Connecticut running. Some months later, however, the tide of Borden's fortune turned.

reopened the Connecticut plant. This second venture, launched during the financial panic of 1857, was soon on the road to failure but was saved by a stroke of good fortune. During a train ride from Connecticut to New York, Borden chanced to sit with Jeremiah Milbank, a wealthy grocer and banker. Out of a casual conversation came an offer to pay all of Borden's debts in return for a share in the business. Fulfilling his part of a bargain that was sealed only with a handshake, Milbank supplied money with which to move the factory to Burrville, Conn., and put it on a sound footing. On May 11, 1857, it opened up as the New York Condensed Milk Company, predecessor of The Borden Company.

Although he didn't know it, Borden was not only condensing the milk but also protecting it against bacterial action by processing it under heat. Thus, decades before Pasteur made his epochal discovery, mothers were raising their babies on pasteurized milk. This undoubtedly saved the lives of thousands of infants.

Borden started production at an auspicious time. *Leslie's Illustrated Weekly* was crusading against contaminated milk in New York City. In this pre-refrigeration era, milk could not be transported far and the city's supply came from local "cowkeepers" who were not sanitation minded. Their animals and premises were not inspected and many babies were dying from typhoid fever and other communicable diseases. *Leslie's* wrote of "swill milk" and "milk murder" and demanded an investigation.

Seizing their opportunity, Borden and Milbank described in newspaper advertisements the purity of their "country milk" and the rigid standards of cleanliness prevailing in their condensery. This last claim was no idle boast. Borden's inspectors sniffed and tasted each batch of milk the farmers brought in and refused to accept any that was warmer than 58°F. Soon the inspectors were also visiting the dairy farms, enforcing a strict sanitary code that became known as the "Dairyman's Ten Commandments." Most of the provisions are now found in state and federal laws. The farmers at first grumbled then accepted the controls, especially since checks paying for their milk were arriving regularly. As condensed milk could be shipped without spoiling, sales boomed. For the first time, a 3-day heat wave didn't sour all the milk available in New York City.

Condensed milk was a boon to troops during the Civil War and the War Department ordered lots of it. Mrs. Lincoln served it at a White House dinner. Borden's daily production soared to 20,000 quarts and more condenseries were opened. Word that the new Eagle Brand milk was safe for infants spread rapidly among mothers and the term "Eagle Brand babies" was coined. The secret of the milk's success was, of course, the pasteurization feature.

Borden didn't make much money from his invention until he was 60 years old. When it came, prosperity didn't change him much and he regularly got to his office at 4 A.M. so that he could get in 5 hours of work before breakfast. Years before he died he selected his burial site in New York's Woodlawn Cemetery and had erected there a large granite likeness of a milk can. He died in Texas—which he called home—in 1874 and the stone was then replaced with a lifesize statue, beneath which is the epitaph he chose:

I tried and failed. I tried again and again, and succeeded.

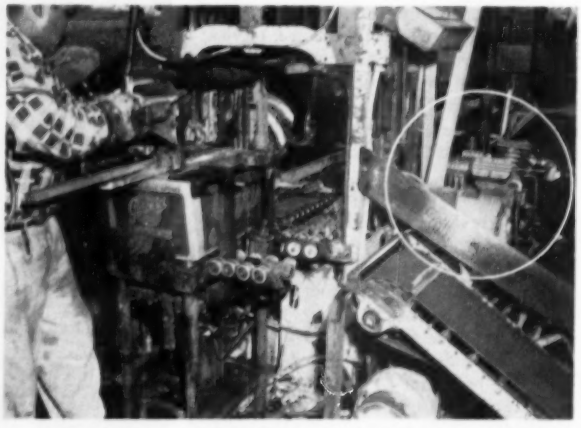
From its founding until 1899 The Borden Company remained a 2-family concern. It was then reorganized as a stock company and its capitalization increased from $3 million to $20 million. In 1875 it began distributing fluid milk in New York City and has since added various other dairy products, coffee concentrate, casein and some chemical products unrelated to milk. The company now operates more than 700 plants and stores, has 33,000 employes, and manufactures or distributes more than 800 products. It delivers milk to a million homes and sells upward of 2¾ billion packages of food a year.

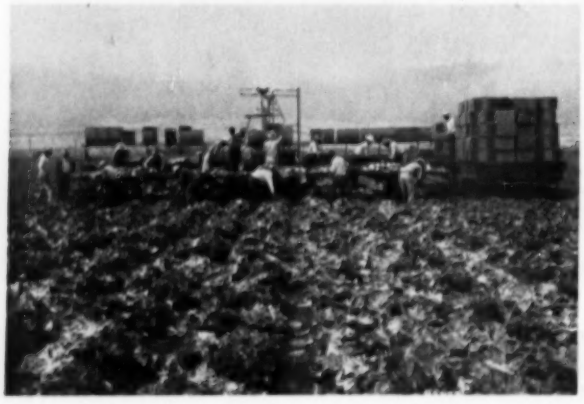
Borden's penchant for cleanliness in processing led him to incorporate in each vacuum pan a manhole through which a man could enter and scrub the interior copper surface "almost bright enough for him to see his face in it." They are still made that way and milk is condensed essentially as it was in 1857, although equipment is larger, more efficient and easier to clean and use. There are single Borden plants that can turn out 85,000 cans of condensed milk a day.

Air Power Aids Lettuce Packaging

LETTUCE must be quickly moved from the field to stores and consumers' tables to keep the leafy greens fresh and palatable. One of the most modern ways of doing the job is to "dry pack" the crop in the field and rush it to refrigerated storage rather than icing or "wet packing" it.

The pictures show how compressed air speeds the harvest and reduces labor requirements. Pickers, walking behind the mobile packaging machine (below), harvest the heads and lay them on a table on the rear of the machine. There they are placed in cartons by packers and sent to an air-powered closing and stapling machine (right). The packed and sealed

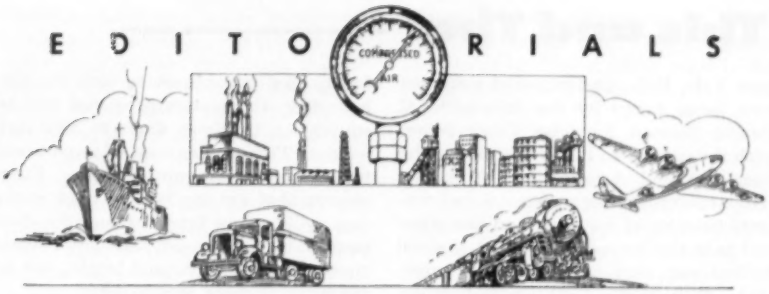




cartons are then relayed by a conveyor to a truck moving alongside. The latter not only carries the packed lettuce away to storage but brings empty cartons to the harvester as well.

Air for the carton closing and stapling device is furnished by an Ingersoll-Rand Type 30 compressor (in white circle). The Model 242 unit delivers air at 90-psi pressure and is driven by a 3-hp motor. Putting compressed air to work on this job has resulted in a 300-percent increase in production over the manual closing and stapling method formerly used.

EDITORIALS



COLOSSEUM SHOWS AGE

WHOLESALE plundering conducted through the ages, plus the vibrations resulting from modern heavy truck traffic have combined to weaken Rome's famous Colosseum so gravely as to call for extensive repairs and counter measures. Other neighboring structures, including the Arch of Constantine, must also undergo rehabilitation. The late emperor Mussolini indirectly and unwittingly contributed to the situation by tearing down the old houses that formerly surrounded the Colosseum and supplanting the narrow cobblestone roads with the new wide Imperial Way. The great stone structure that was considerably damaged by the Vandals, Goths and other barbarian invaders has fallen victim to more serious results from endless shocks of pounding vehicles transmitted through the ground.

The pillaging of the Colosseum went on for centuries and was in accordance with accepted Roman custom. Instead of quarrying fresh stone for erecting buildings, it was easier and much cheaper to rob some of the existing structures that were no longer in use. Being the largest source of choice stone, the Colosseum suffered heavily. The practice was stopped in the eighteenth century by Pope Benedict XIV, who held that the structure was sacred ground because Christian martyrs were believed to have died in its arena.

Blocks of stone crashing down from the 187-foot-high eastern wall of the Colosseum gave notice that all was not well and brought on an investigation. This determined that the thousands of vehicles that pass there every day were slowly shaking the historic pile to pieces. Corrective measures were immediately planned and undertaken and straw matting and scaffolding now screen portions of the walls while workmen behind them take the prescribed steps. The decision to act at once may have been influenced by recalling the dire prediction by the sixteenth-century British monk, "Venerable Bede," that when the Colosseum fell, Rome and the rest of the world would also collapse.

Reinforcement of the walls consists mainly of removing huge iron braces that were put there a century ago and replacing them with steel members. Aside from the resulting strengthening effect, it is claimed that the structure's appearance will be improved. The cost of the repairs is estimated at $160,000.

Although long unused, the Colosseum is still regarded as one of the world's choice examples of stone construction and is also a memento of a golden age in Rome's history. The Roman emperors prided themselves on creating beautiful and lasting edifices. It was the boast of Augustus, the first of the line, that he found a Rome of brick and left one of marble. His successors ably continued what he had started.

At first the architects used local stone —chiefly different kinds of tufa, a soft rock of volcanic origin on which most of Rome rests. It lacked both strength and beauty and other varieties were soon sought farther afield. The search led to the discovery of large deposits of travertine at Tivoli, only 16 miles away. These had been overlooked previously because the region was flat and overgrown with vegetation. At Tivoli were hot springs and baths frequently visited by Romans who had overindulged. The rising waters carried calcium carbonate in solution and carbon dioxide gas, considered to be the prime requisites for the formation of travertine. This unique rock is often as full of holes as a Swiss cheese, but its structure belies its strength and wearing qualities. Technically it is a variety of onyx. Commonly of a warm straw-to-buff color and having a soft luster, it is especially desirable for interior use. It was so applied in volume for the first time in an important American structure when Stanford White, New York architect, specified it for the walls and steps in the Pennsylvania railroad station there. It has since proved its indifference to the wear of millions of shuffling feet.

Augustus's architects used the stone extensively in the walls and arches of the Colosseum. Later it became the custom to face buildings with veneers of marble, granite and other costly stones and back them up with tufa or concrete, but this technique was not known when the colosseum arose and it contained great blocks of choice material aggregating thousands of tons. The seats where from 40,000 to 50,000 spectators clustered about the central stage or arena were made of marble obtained in the province of Carrara.

The Colosseum is the largest of the Roman amphitheaters. Initially they were built for the staging of gladiatorial contests, but the attractions later took on varied forms, including the reputed tossing of Christians to the lions. The Colosseum in Rome was officially designated the Flavian Amphitheater, and acquired its present name several centuries later. Its construction was begun by Vespasian about 75 A.D., and completed by his son, Titus, 5 years later. Of elliptical shape, it measures 617x511 feet and its arena was 282x177 feet. The latter was elevated and beneath it was a labyrinth of passageways that connected rooms provided for gladiators, wild beasts and other performers. These were introduced into the arena through numerous trap doors at various points. There were provisions for flooding the arena for the staging of naval sham battles. The lower tiers of seats were for state officials, the intermediate ones for the wealthy or noble classes and the upper ones for the rest of the populace. Apparently all seats were reserved, as they bear numbers.

AEC BIRTHDAY

ON JANUARY 1 the Atomic Energy Commission completed 10 years of operation. No 10 years of activity by any group since the world was created has had such far-reaching effects and forebodings. The developments in which the AEC has had a vital part have changed age-old concepts, tightened international tensions and made uncertain the fate of people still unborn and civilizations now unbuilt.

They have made us players in a gigantic guessing game. We speculate on how much our potential or possible enemies know about nuclear weapons and they are probably equally zealous in their wondering about us, despite our policy of reporting rather freely on our actions.

One of the few things of which we are certain in this period of great uncertainty is that the nuclear age is expensive. From 1950 to 1953, AEC construction accounted for three percent of the U.S. total, both in dollar value and labor force employed. To date the AEC program has cost American taxpayers $15 billion.

Nuclear power is a coin of two sides, one presaging destruction or even annihilation and the other promising peacefull progress. If we can flip it skillfully enough, we are safe. The potential benefits of atomic power plants and isotopes are enormous. Properly guided and exploited, this great force can unquestionably better our lot, although it may fray our nerves a bit in the meantime. A man can live comfortably and happily with a tiger—as long as the tiger is in a cage. The world now figuratively has such an animal by the tail. The big job ahead is to hold that tiger.

This and That

Air Power Gaining Sharply

More than half a million air-control valves were installed in American industrial plants in 1956, according to R. J. Cameron, president of Ross Operating Valve Company, the largest maker of valves of this type. He predicts an increase to around 750,000 in 1957.

"The major reason for this increase," he states, "is that engineers and technicians are gaining a greater knowledge of the application of air to power manufacturing processes. Many laborious hand operations such as clamping parts to fixtures, transferring parts between machines, lifting and lowering are being done by compressed air. This turning from muscle to air power is further accelerated because air is clean, with control valves it is fast, no return lines are necessary, minor leaks do not cause down time and equipment for producing this power is less expensive in many applications than any other form of power."

* * *

Robot Steel Mill

A steel-rolling mill that is controlled by punch cards is operating daily at the Brackenridge Works of Allegheny Ludlum Steel Corporation in Pittsburgh, Pa. The cards are inserted in an electronic reading device and, when a button is pushed, electrical impulses are sent to a master controller that activates the mill. The holes in the cards determine the number of passes the material makes through the mill, the speed of rolling and the sequence and amount of slab reduction.

The card system is intended to improve the quality of the product and increase the mill's output. It permits performing the rolling operation in exactly the same way every time and this produces material of uniform quality and unvarying desirable physical properties. The cards call for as high as fifteen passes through the mill with accuracies of about 0.01 inch. Six possible speeds are predetermined and recorded on the card.

* * *

Aid for Stymied Salmon

A fascinating branch of construction is the building of "ladders" or runways for fish. It is now usual to incorporate some provision of this sort in all dams erected on western rivers that are traveled by salmon en route to their ancestral spawning waters. Occasionally Nature herself unwittingly creates a barrier to their passage and man has to lend a helping hand to circumvent it. In July 1955 two obstructions were discovered in the Fraser River near Yale, B.C., and remedial steps are now being taken by the International Pacific Salmon Fisheries Commission, with the cost to be borne equally by the Canadian and American governments. One structure will be a conventional concrete fishway 88 feet long and the other will take the form of an 80-foot shallow baffled cut through a bedrock ledge. Only 2170 sockeye salmon out of an estimated 30,000 to 50,000 that tried got by the obstruction during an 11-day period of observation in 1955. It is estimated that future salmon harvests will be reduced by $400,000 worth before favorable conditions can be restored for the spawners to reach their objective waters.

* * *

Pushing Back Space

Two Westinghouse research physicists, Dr. E.J. Sternglass and Milton M. Wachtel, have developed an electronic tube, 3 inches long and 2¾ inches in diameter that, when hooked up to the 200-inch Hale Telescope at Mount Palomar, Calif., will reportedly increase the brightness of images in the sky from 10,000 to 20,000 times. Current investigation of space is limited to 2 billion light-years, or 12,000 billion billion miles. This device is expected to make discernible everything within a distance of 6 billion light-years (36,000 billion trillion miles). The Image Multiplier, as it is called, will be tested first with two smaller telescopes at the U.S. Naval Observatory, Flagstaff, Ariz., and at Mount Palomar. When it is finally used in conjunction with the 200-inch disk, the results produced will be equivalent to those from a 2000-inch mirror. Two applications of importance to astronomy are anticipated. First, objects that are too far away for study now, will become bright enough for close inspection; and second, stars and planets that are already near and bright, can be examined in more precise detail.

"I've checked the catalytic agent, determined the atom flow rate and according to my calculations, we'd better get the hell out of here!"

* * *

New Way To War On Insects

One of the most important advances in weed control was the isolation of various plant hormones that can cause an unwanted plant to grow so energetically that it literally burns itself up. Now a scientist at Harvard University has succeeded in isolating a so-called juvenile hormone from the abdominal section of male silkworm moths. Carroll M. Williams, the researcher, reports that when a tiny amount of this substance is applied to insect larvae, the region touched by the hormone immediately begins to transform into an adult insect, while the rest of the body remains in larval form. The resultant creature soon dies for lack of adaptability. Williams points out that such hormone control of insects has many advantages—for one, an insect is not likely to develop an immunity to a hormone, but can become resistant to poisons such as DDT.

* * *

Better Magnets Promised

A new material which may lead to the development of magnets more than twice as strong as the best now commercially available has been developed by physicists of General Electric Company. It is made up of tiny, submicroscopic particles of iron in a matrix or carrier of a non-magnetic substance such as glass or plastic. According to the scientists, the excellent magnetic properties of such a compound have long been suspected, but no one was able to make particles of exactly the right size and shape. Now the physicists at General Electric's measurements laboratory have found a way to do it by adapting a century-old electrolytic process in which iron is electroplated into a cathode of a liquid metal such as mercury. They have made particles less than a millionth of an inch in diameter, but from two to ten or more times as long. The explanation for the superior magnetic properties of the as yet unnamed compound is that each particle is so small that it represents only one magnetic "domain"—is almost the smallest possible particle which can still be a magnet.

Therefore, according to the researchers, it retains its magnetism much longer and under more adverse conditions than do larger magnets. The particles are suspended in the glass or plastic matrix and are aligned in reference to their polarity by subjecting the compound to a strong magnetic field. Then the material is compressed to increase its density and "freeze" the particles. The G.E. scientists already have produced particle magnets as strong as those available from conventional alloys and think that they can do twice as well, if not better.

* * *

Colors To Guide Traffic

In California, traffic engineers are dyeing roads. The purpose is not to beautify the countryside or to relieve the monotony of endless strips of monotone whites and blacks, but to see if the idea has merit for directing traffic, particularly through the mazes of roads which lead off from some of the modern cloverleaf patterns associated with limited access, high-speed expressways. So far the researchers have tried out extremely long-lived green and blue dyes, mixing them with the concrete at the time it is poured. If the idea works out, the through lanes will remain the standard concrete white, but others will be of different colors. Traffic signs will read something on the order of: "Follow Red Lane to Anaheim" or "Take Blue Route to Santa Monica." Something of the same sort is now in use under Times Square, New York City. In the subways which intermix at that busy junction in a bewildering maze, lines of overhead lights of appropriate color guide the scurrying commuters and visitors to the city between the main uptown and downtown lines and the shuttle line that joins Times Square and Grand Central Station.

* * *

Yule Tree Big Crop In Canada

Sales of "Christmas" trees during the past holiday season enriched Canadian coffers by more than $8 million. Official sources estimate the harvest at well in excess of 16 million trees, more than half of which came from the provinces of Quebec, Nova Scotia and British Columbia. As Dominion homes total scarcely one-quarter that number, it is plain that most of the trees were exported. Sales of Canadian trees in this country rose from 11 million in 1949 to 16,700,000 in 1955 and in the latter year Uncle Sam got more than one-third of his total supply from north of the border. The balsam fir is the most popular variety in eastern Canada and eastern United States and comprises around 70 percent of the exports. Douglas fir leads in western Canada and accounts for 19 percent of the export total. The remaining 11 percent is divided about equally between Scots pine and spruce.

* * *

Air Tests Luckies' Wrappers

A recent advertisement by The American Tobacco Company deals with the use of compressed air to test the cellophane envelopes in which Lucky Strike cigarettes are wrapped to keep them fresh. Pictured was a device in the company's laboratory that puts them under air pressure to measure their bursting strength. Cellophane wrappers for this purpose ar taken at random from packs of cigarettes that are purchased from stores or obtained from the factories where they are produced. The advertisement stated that the test is repeated tens of thousands of times annually as a part of the company's quality-control program.

* * *

Many Uses Loom for Microfibers

Organic microfibers are now being made by a new patented process that was developed for American Viscose Corporation by Arthur D. Little, Inc., of Cambridge, Mass. Organic plastics such as vinyl, acrylic, nylon and polyester resins, as well as amorphous materials such as asphalt are melted or dissolved in volatile solvents and then sprayed into an air stream to form superfine fibers. During the spraying the microfibers may be mixed with rayon or other fibers and the mixture deposited on a moving belt to form a web. The microfibers are unique in having a permanent electric charge, irregular lengths and diameters from 0.5 to 10 microns.

The extreme fineness of the fibers makes the webs highly absorbent and they may be used in sanitary products, dentists' rolls, inking pads and typewriter ribbons. The static charge on the fibers renders them useful, alone or in blends, as filters for gas, oil, water, dust and smoke. Uses are foreseen in gas masks, filters for automotive vehicles and air conditioning equipment. Other possible applications are in non-woven fabrics, insulation layers for sleeping bags and winter clothing. American Viscose Corporation intends to license other concerns to manufacture under the new process.

"Fenton—no replacement will ever do the job you've done here—I hope."

* * *

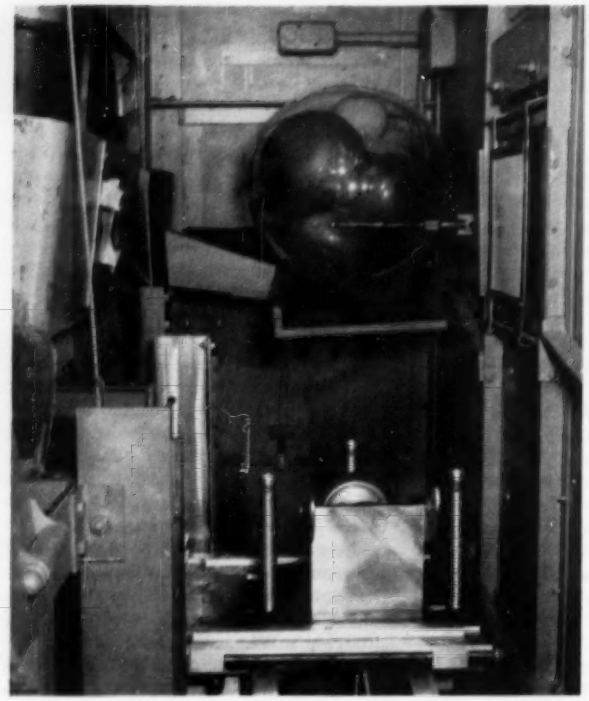
Tunnel Built In Dry Dock

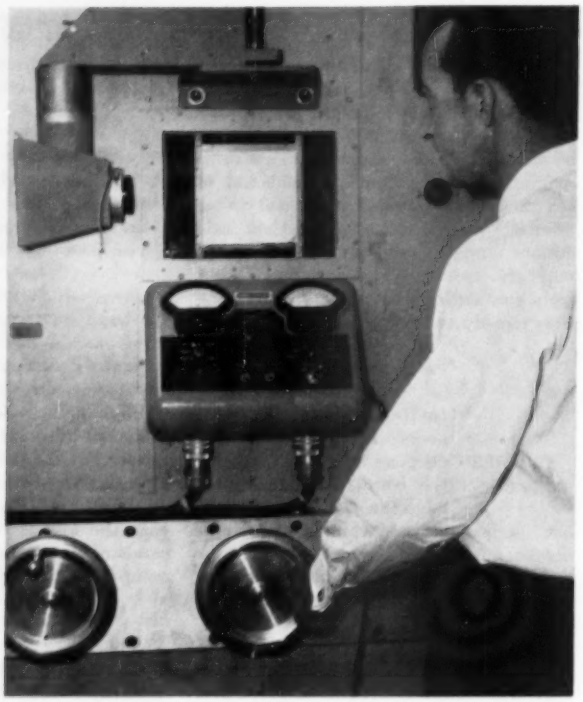
The first section of a reinforced-concrete vehicular tunnel that will join Havana and East Havana, Cuba, was laid on the bed of the harbor a few weeks ago. Four other sections will be put in place and interconnected. They are being built in dry dock, towed into the channel and lowered into a trench excavated by dredging. When completed the tunnel will be 1706 feet long, almost 72 feet wide and 24 feet high. It will carry two lanes of traffic in each direction. The work is being done by a French company, La Societe des Grands Travaux de Marseille under a contract that calls for completion in 31 months. Havana is growing rapidly but has spread little to the east because of poor connections in that direction. The tunnel is expected to remedy this.

* * *

Federal Aid for Science and Research

According to a survey by the National Science Foundation, the Federal Government will spend $2.7 billion on basic scientific research and development during 1957. The biggest spender will be the Department of Defense with $1.9 billion earmarked for science. Next in line are the Atomic Energy Commission with $529 million; the Department of Health, Education and Welfare with $110 million; and the Department of Agriculture with a research budget of $103 million. The National Advisory Committee for Aeronautics will get $80 million; the Department of the Interior, $44 million; the Department of Commerce, $24 million; and the National Science Foundation itself, $43 million. Of the latter sum, NSF will spend $18 million on the widely publicized earth satellite project. The 1957 expenditures represent a 12-percent increase over 1956 and almost 20 percent over 1955. Basic research will get about 9 percent of the total funds while the remainder will be spent on applied research, expansion of plant and laboratory facilities and special equipment.





INTERIOR AND EXTERIOR VIEWS

The big plastic ball in the picture at the left is mounted ready for inspection between the fluorescent screen and the X-ray tube. It rests on an inclined platform that can be raised and lowered and rotated so that the technician can examine the small casting inside of it from any angle. (The edge of one is barely visible above and behind the balloons.) The operator of the machine is shown at the right in his shielded booth and is facing the viewing screen. He has his hand on the wheel that turns the ball. The latter consists of two halves: the lower one in which the casting is laid and the upper which holds the inflated balloons. At the top-left is a camera attached to a swivel arm.

Balloons Aid Fluoroscopic Check

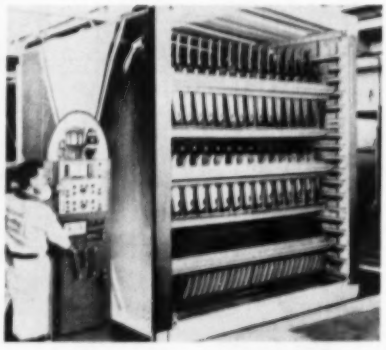
INTERESTING experiments are being conducted in the plant of Chance Vought Aircraft, Inc., to evaluate the usefulness of a high-intensity fluoroscope developed by the U.S. Naval Ordnance Laboratory, White Oak, Md., for the Bureau of Aeronautics, which has authorized the work. The purpose of the new device is to detect flaws in metal castings for airplanes and, at the same time, determine its superiority, if any, over conventional X-ray filming as to accuracy and rate of inspection.

Approximately 2000 large and small steel and magnesium castings are being tested. These have already been checked by the conventional method, but the technician is not informed beforehand of the findings. He keeps a detailed record of his results, which are then compared with the initial X-ray films.

To facilitate handling the small parts to be examined in the fluoroscope, each is placed in a plastic ball where it is held in position by inflated rubber balloons, the kind children play with. After sealing, the globe is mounted on a platform between an X-ray tube and an 8-inch viewing screen. From his position in a shielded booth, the technician can rotate the ball in any direction, thus enabling him to inspect the casting from all angles for cracks, porosity, voids and other flaws.

The Navy recently sent the company a new 150-kv high-intensity X-ray head for the machine that has a smaller focal point, thus giving it greater penetrating power to handle thicker castings or to find smaller defects. The fluoroscope is also going to be tried out on switches, vacuum tubes, fusion weldments, relays and other aeronautical parts to determine if it will lend itself to quicker than normal and more accurate checking. When the first 2000 castings have been examined, a report will be sent to the Bureau of Aeronautics for the purpose of evaluating the potential usefulness of this modern inspection device.

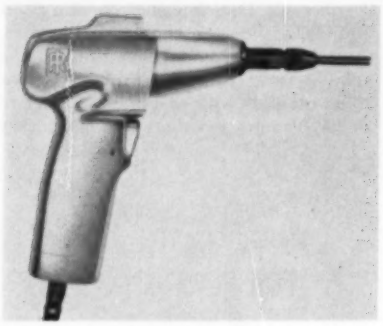
Super Shaker Simulates Railroad Jostling



For manufacturing automobile bodies, the Fisher Body Division of General Motors Corporation receives glass, metal and other materials by railroad at 35 plants in 22 cities and eleven states. It also ships the made-up body parts to seven General Motors assembly plants in this country and 22 abroad. In order to design loading and packaging aids that will insure transport of the materials with a minimum of damage, it is necessary to know just what goes on in freight cars as they roll around the country. To shorten the process of gathering this information the division has built an exact replica of a car that can duplicate in one hour all the shake, rattle and roll experienced by a regular car during 1000 miles of travel. A Brush oscillographic system measures and records every vibration—upward, downward and sidewise. The picture shows body parts hanging in the test facility. Fisher engineers call their 1-car test installation the "shortest railroad in the world."

Industrial Notes

For use wherever electrical wire connections are needed, Ingersoll-Rand Company has developed a hand-held wire-wrapping tool that may be powered electrically or pneumatically. Stripped wire is inserted in a loading groove and anchored to a notch in the winding bit. This is placed over a terminal lug. By pressing a trigger mechanism, connecting wire is wound, under high tension,



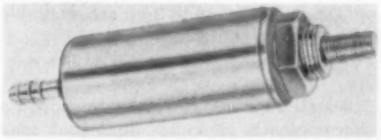
around the terminal piece at a rate of about six turns per second. The result is a tight spiral joint that not only withstands corrosion and vibration, but one that also is stronger and freer from electrical resistance than soldered types. Use of this machine reportedly reduces production time and costs. More uniformly made connections may be closely spaced, quickly installed and easily removed when necessary. The tools provide long service life, feature anti-friction ball and needle bearings throughout and have easily interchanged winding bits and sleeves. The pneumatic unit pictured has a simple, foolproof, single-piston motor that drives a rack and pinion, one piston stroke producing the required number of turns. Air consumption is thus kept to a minimum because the tools operate only when actually winding.

Circle 1E on reply card

Magnus Chemical Company, Inc., has developed a series of X-3 spray-wash compounds that, regardless of concentration or high temperature, will not foam. This characteristic allows maximum wetting of dirt deposits on metal. Built-in hard water control prevents scale formation and free-rinsing properties leave surfaces cleaner, it is claimed. Three strengths are available for use on hard, medium and soft materials.

Circle 2E on reply card

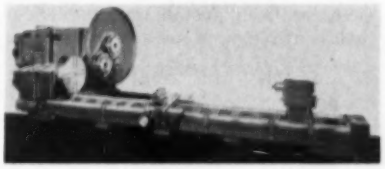
Bimba Hardware & Manufacturing Company is now producing, in volume, a non-repair type air cylinder, Model 091. It features a stainless steel body that reportedly gives it exceptionally long service life and a low-cost construction that allows it to be discarded when worn out. A vinyl U-cup, mounted in an aluminum alloy piston, slides within a



stainless steel body, the inside of which is ground to a 10-micro-inch finish. An air hose adapter is secured to a hole in the bottom of the body. The open front end is fastened over the piston rod guide by rolling the front edge of the body into a groove on the outside of the guide. This connection is permanent and can be broken only by destroying the body and guide. A lock nut secures the cylinder to the mount. Of single-acting spring-return construction, this low-cost fixture can be used in clamping, moving, holding, ejecting, pushing and similar operations. The unit exerts a force equal to 90 percent of air line pressure for a maximum 1-inch stroke.

Circle 3E on reply card

The Boye & Emmes Machine Tool Company is offering a dual-spindle lathe designed to provide facilities for turning both large- and small-diameter work. The upper spindle provides an over-the-bed swing of 60 inches and the lower unit provides one of 40 inches. Both are positioned in a manner to give the utmost convenience in operation because the point of contact between work and tool is always within easy sight and reach. The various drives may be engaged or disengaged at will; however, according to the manufacturer, they are



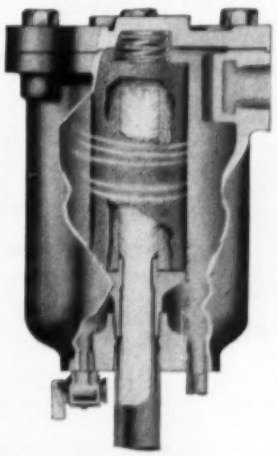
always under the protection of a mechanical safety-interlock arrangement that prohibits machine-damaging movements. Beds may be had in any required length and up to 15-ton loads may be supported between centers. All standard attachments are available and applicable.

Circle 4E on reply card

An air control system for high-accuracy fractional horsepower variable speed drives delivering from any desired

ADAMS PORO-STONE AIR FILTER

designed to remove oil, water and foreign matter from compressed air lines with minimum pressure drop.



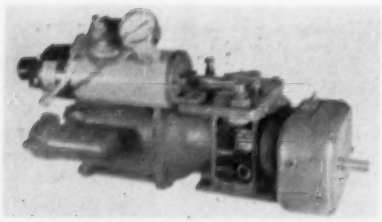
The R. P. Adams Poro-Stone air filter is engineered to efficiently remove entrained oil, water and pipe scale from compressed air lines. Liquid droplets and solids being carried by the gas stream are first removed by centrifugal action in an annular chamber. Secondary filtration is achieved by passing the air or gas stream through a Poro-stone unit. An automatic trap can be provided to discharge the residue from the cyclone chamber.

At rated capacity the filters operate at a maximum pressure drop of only ½ lb., thus insuring delivery of line pressure to the point of consumption.

The units require virtually no service or maintenance — thereby insuring continued trouble-free, low cost performance.

ADAMS Poro-Stone air filters are available from stock in sizes to suit your needs. For further information, write today for Bulletin 117, R. P. Adams Co., Inc., 209 East Park Drive, Buffalo 17, New York.

Circle 17A on reply card



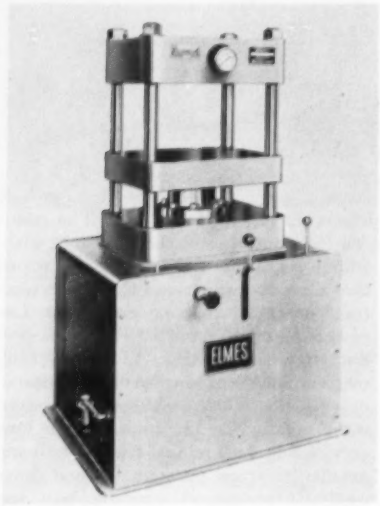
speed from maximum to zero and reverse, is manufactured by Graham Transmissions, Inc. The unit operates on a 3- to 15-psi signal originating from liquid-level, pressure or flow-rate devices; or from pneumatic recorders or their controllers. According to the company, the transmission is available with a wide variety of built-in reducers, including spur and worm types. Speed usually is regulated as a linear function of pressure, however controls based on square root and other functions may be obtained. Units up to 3 hp are available with similar controls.

Circle 5E on reply card

Jessall Plastics, Inc., has developed a thermoplastic conveyor duct that may be adapted to pneumatic, mechanical or gravity methods of transporting workpieces from one station to the next without manual handling. The tubes, extruded in straight lengths and available both in five standard sizes for moving material from ⅛ to ½ inch wide and ½ to 1⅝ inches high as well as in custom dimensions, is not only exceptionally durable, but according to the manufacturer, may be cut and twisted to suit individual needs, will not support combustion and is self-extinguishing. Accumulated oil or residue can be easily blown out with compressed air.

Circle 6E on reply card

Hydrolair, a low-cost air-powered hydraulic press manufactured by Elmes Engineering Division of American Steel Foundries, is easy to install, operate, maintain and move. According to the manufacturer, the unit, available in four standard sizes with maximum ratings of 30 to 100 tons, is valuable in laboratory



research work, laminating, compacting, rubber molding, gluing, etc. Equipped with simple, convenient controls, it can be set for any pressures ranging from 5 tons to the maximum by regulating an air-pressure valve. Build-up of preset pressure is virtually instantaneous and full power is maintained throughout the stroke. Operating air is normally obtained from the shop supply, but if none is available a 5-hp air compressor operating at a pressure of 40 to 60 psi can power about eight 30-ton or about six 50-ton units cycling about once a minute.

Circle 7E on reply card

Gap presses ranging in capacity from 100 to 300 tons in both single- and double-crank types are being marketed by Hamilton Division of Baldwin-Lima-Hamilton Corporation. Although the units were developed primarily for shallow-drawing, forming and blanking duty in the automotive industry, they are applicable in other fields as well. Bed areas are large enough to accommodate the more sizable blanks that are formed into automobile bumper guards and

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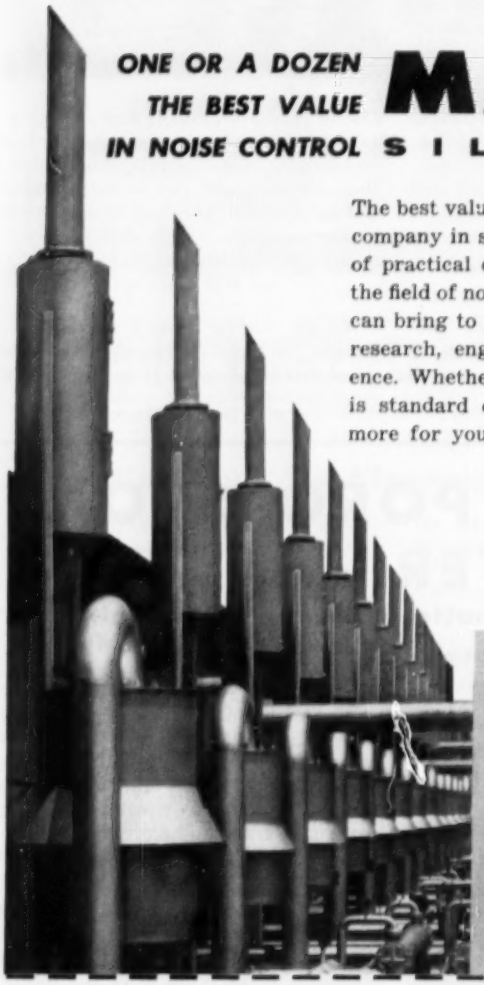

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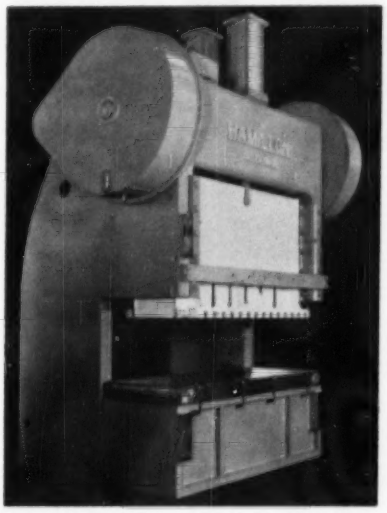
grilles. Each machine incorporates a pneumatically operated flywheel brake, clutch and counterbalance. Motorized slide adjustment is accomplished through barrel-type screws that remain vertical



during all stroke positions. The clutch is cool operating and permits single tripping at a rate very close to continuous operation. Welded-steel frame and slide construction of great strength and rigidity reportedly assures low deflection. Main and intermediate gears run in oil to afford positive lubrication.

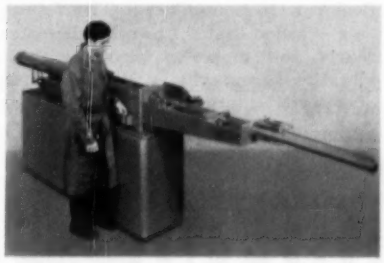
Circle 8E on reply card

By combining magnetic, pneumatic and automatic action, Hankison Corporation has developed a device to free air and gas lines of condensate. Condensate in the unit, called the Mag-Pneu-Power Trap, rises but a float is

held in place by a magnet mounted on a pivot arm. When sufficient force is built up to overcome the magnetic bond the float rises and snaps open a pilot valve. Air then enters and forces a piston assembly upward, thus opening a main discharge valve through which the condensate is forced. This assembly is completely sealed off from the matter that is discharged to prevent damage or clogging. When sufficient waste has been emitted to lower the float, magnetic attraction takes over and snaps the pilot valve shut. Air is thus cut off from the piston, causing it to return to its original position. According to the manufacturer, pressure range of the trap is from 10 to 200 psi.

Circle 9E on reply card

A Red Ring self-contained, pneumatic broaching fixture that features semi-automatic loading and automatic handling and part ejection, is now available from National Broach & Machine Company. Three air cylinders are used: one for each operation in the cycle. The part to be machined is deposited on a loading platform and a start valve pressed. The first cylinder advances a puller through the hole to be broached and into an automatic pull head that is guided by linear ball bushings. When the broach is drawn through the part, the loading



platform is tipped up and the part ejected into a chute. While the machine is in this position, the pull head returns the broach into a retriever which carries it back to clear and lower the platform, thus completing the cycle. The unit is designed to be either bench-mounted or furnished with a welded steel base and coolant supply pump, according to the company.

Circle 10E on reply card

Tar, welding flash, paint smears and all sorts of foreign matter can be easily stripped from reciprocating mechanisms in machine tools, hydraulic and pneumatic cylinders and the like, according to Equi-Flex Products Division of Master Pneumatic, Inc., by using a 360-degree non-clogging metallic rod wiper/scraper. The fixture, available in all popular sizes, utilizes a spiral-wound scraper ring honed to fit tightly, yet lightly, and an injection-molded-elastomer annular-shaped element. Generally, the latter is made of a high grade buna compound that is compatible with most mineral base oils and hydraulic fluids within temperature ranges of –40° to 250°F; however, it may be special-

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Air
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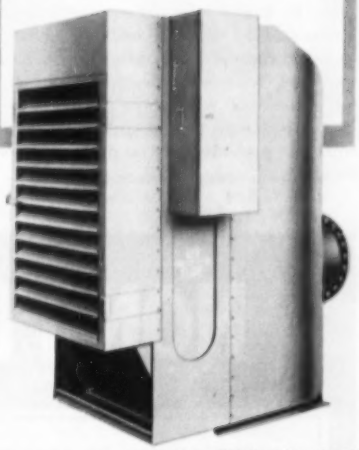

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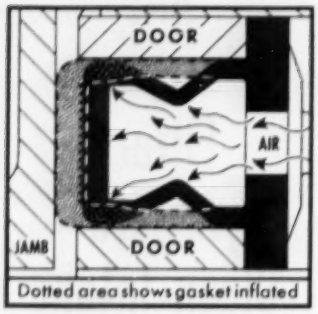
Circle 19A on reply card

ordered for applications with which the standard elastomer may not be suitable, as with non-flammable hydraulic fluids.

Circle 11E on reply card



Continental Rubber Works has developed an air-operated rubber gasket for doors that, when inflated to approximately 30-psi air pressure, insures complete, positive seal. The device reportedly works well either with an intermittent flexing cycle (with time allowed for removal of the air) or as a continuous seal. It is available in square or round forms and for use with either pressure or vacuum rooms. The units can be manufactured with any desired number of valves, all of which are located on its flat flange surface. Openings, however, must be provided in the door for access to them. *Circle 12E on reply card*

To raise, lower and move loads of up to 2000 pounds, Dayton Rogers Manufacturing Company has developed an elevating table shop truck called Lift-A-Load. The unit, with table-deck dimensions of 25x37 inches and a height range of 24 to 42 inches, has both high- and low-ratio lifts for light and heavy loads respectively. It is claimed that its extra heavy four-post design distributes the load and prevents tipping while an improved floor lock mechanism and self-locking screws guard against backing off or dropping of loads. Optional accessories include a roller-conveyor top for easy feeding of strip and sheet stock and a tilt top that is adjustable to press bed angles for incline punch operations.

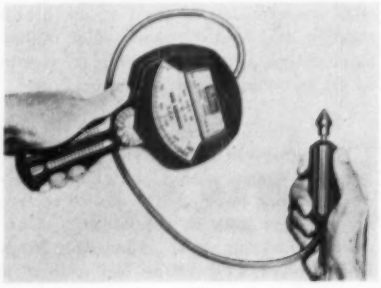
Circle 13E on reply card

Portable, self-contained, pH measuring and recording instruments that require no external power supply may now be obtained from The Bristol Company. They are suitable for field surveys of stream pollution, waste-treatment-plant effluent and industrial water supplies. The device consists of two compact units that weigh less than 50 pounds: a Bristol Model 524 pH recorder and a Beckman N-2 amplifier. The former uses carbon-coated 8-inch diameter charts and makes a record with a vibrating-type stylus. Various types of electrodes are available, including

those for immersion, flow and laboratory applications. According to the manufacturer, the equipment will cover the total pH range of 0 to 14 in two partial spans of 0 to 8 and 6 to 14.

Circle 14E on reply card

The Metron Hand Tachometer minimizes confusion and reading error in measuring speeds from 2 to 100,000 rpm because it includes a thumb-operated range selector that automatically changes and brings into view the correct scale for the desired range. This product of



Metron Instrument Company operates on a commutated-capacitor principle, therefore overspeeding or wrong range selection does not damage it. A built-in calibration circuit gives a quick, positive check on performance. According to the manufacturer, this rugged, permanently lubricated, lightweight device features sustained accuracy, long service life, low operating torque and rapid response. *Circle 15E on reply card*

Barksdale Valves has added to its existing line a 1½-inch 4-way valve for service up to 250 psi. The stainless steel and aluminum unit incorporates the Shear-Seal principle of a pressure-balanced, self-aligning tubular sealing ring that remains in perfect contact with an optically flat porting disk or rotor containing the flow passage even after years of service, it is claimed. Because flow is never across sealing surfaces—but is rather through the shear-seal—and because the square external corner of the shear-seal wipes the rotor clean, no dirt

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Remember, your new pneumatic tools will in all probability have been test run and rust proofed with NON-FLUID OIL, with the manufacturer's recommendation that you continue to use it to get the most from your tool investment.

Send for a sample of NON-FLUID OIL, and see for yourself how it stops harmful rust and sticking, and speeds up tools instantly.

NEW YORK & NEW JERSEY LUBRICANT COMPANY
292 MADISON AVE., NEW YORK 17, N. Y.
WORKS: NEWARK, N. J.

1896 60 YEARS 1956 — NON-FLUID OIL — SERVICE TO INDUSTRY

WAREHOUSES

Birmingham, Ala.	Greenville, S. C.	Greensboro, N. C.
Atlanta, Ga.	Chicago, Ill.	Detroit, Mich.
Columbus, Ga.	Springfield, Mass.	Providence, R. I.
Charlotte, N. C.		St. Louis, Mo.

NON-FLUID OIL is not the name of a general class of lubricants, but is a specific product of our manufacture.

Circle 20A on reply card

can enter between the sealing surfaces to cause scoring that destroys sealing qualities. With each actuation, it is said, the area actually laps itself into a more perfect seal. This principle has proved especially effective where positive shut-off is important.

Circle 16E on reply card

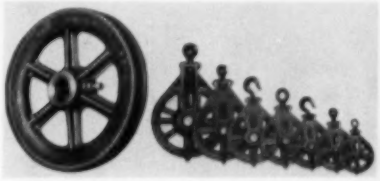
For applications where a large volume of loose material must be picked up, Clarke Sanding Machine Company offers a device called Xtra Tank Adapter. The unit fits any ash can or drum up to the 30-gallon size and may be used in combination with any portable heavy-

duty vacuum cleaner with a hose 1½ inches in diameter. It is reported to be particularly effective for recovering metal and cleaning furnaces and boilers. Time spent in emptying filled containers is eliminated because the adapter can be easily changed from one to another as each becomes filled.

Circle 17E on reply card

Selas Corporation of America has redesigned its Flo-Scope. The instruments, known as Series F, measure flow rates of gases and air, separately or in mixtures, for combustion in furnaces and ovens, in generating units and in the production of industrial chemicals, pharmaceuticals, coating materials and foodstuffs. The units reduce installation and maintenance costs by permitting 1-man panel mounting and simplified cleaning procedures. According to the company, they are capable of handling capacities up to 75,000 cubic feet of air per hour. Every unit is calibrated to meet individual flow conditions and continued accuracy is assured because the only moving part is not subject to wear.

Circle 18E on reply card

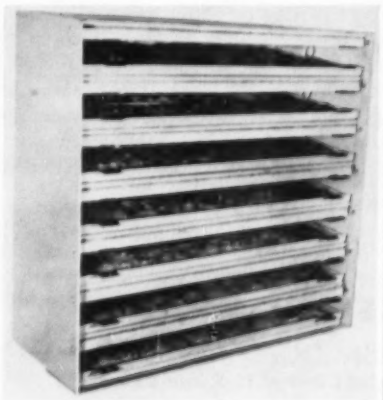


Durolite wire-rope blocks featuring end-thrust bearings to prevent side-frame wear, free-moving swivels for easy positioning and a cast bead on the side frames to prevent fouling, may be bought in 6- to 18-inch sizes with bronze bearings and in 8- to 42-inch dimensions with roller bearings. Special types will be built on request to meet individual specifications. These units are manufactured by Sauerman Brothers, Inc., and are used on all of its DragScraper machines and cableways where they have reportedly reduced wear on running ropes.

Although Durolite sheaves are lighter in weight than other units of similar rated capacities, they are said to provide high structural strength and durability for handling heavy loads at high speeds. They start instantly and stop without spinning. These fixtures are produced in alloy- or cast-steel varieties, in 6- to 18- and 20- to 24-inch sizes respectively.

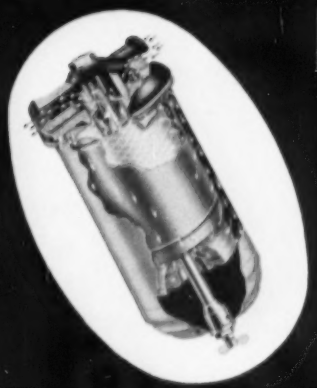
Circle 19E on reply card

Multi-Pak, a high-efficiency, dry-type air filter is being produced by American Air Filter Company, Inc. Each unit consists of seven renewable mats slipped into pockets. By varying



their density, thickness and texture, it is possible to obtain any desired efficiency, even at extremely high temperatures, in dust and smoke removal ranging from plant pollen to tobacco smoke. According to the manufacturer, the design of one 24x24x22¾-inch unit yields more than 50 square feet of filter area.

PROLONG THE LIFE of your air-operated equipment with Fulflo FILTERS



You can make substantial savings through longer tool life and trouble-free operation by keeping your air lines *clean* with Fulflo Filters. Fulflo minimizes troublesome gumming — protects your air-operated equipment by removing rust, scale, dirt, abrasive dust, moisture and oil from your air lines.

Fulflo Filters employ *genuine* Honeycomb Filter Tubes which provide true *depth* filtration through hundreds of diamond shaped filtering tunnels. You get any desired degree of micronic clarity with minimum pressure drop. Special models operate at pressures as high as 4,000 psi. Rugged construction provides for years of service.

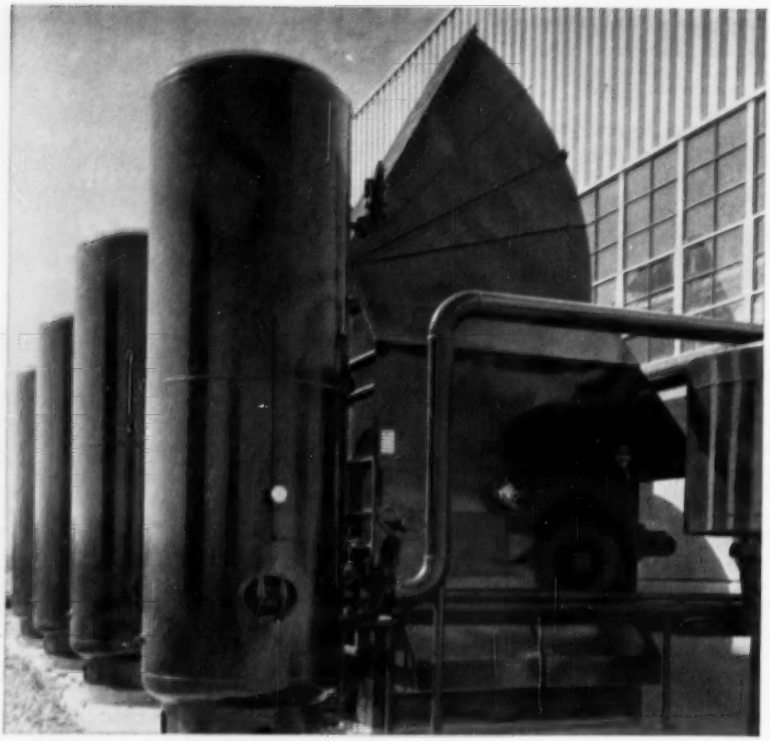
Because of low unit cost and compact unit size, a separate Fulflo Filter can be installed at every point of use. Multiple tube models are available for high flow rates or for central installations. Inexpensive Honeycomb Filter Tubes last for several months under average operating conditions, and are easily replaced. Be sure to insist on *genuine* Honeycomb Filter Tubes.

Commercial Filters engineers are ready to help you with any problems involving filtration of compressed air, carbon dioxide, and other gases. Write for technical literature to Department CA.

COMMERCIAL FILTERS CORPORATION
MELROSE 76, MASSACHUSETTS

Plants in Melrose, Massachusetts and Lebanon, Indiana

Circle 21A on reply card



HOW YOU SAVE,
Getting Drier Compressed Air

● Direct saving in the cost of cooling water saves the price of the Niagara Aero After Cooler (for compressed air or gas) in less than two years.

Extra, for no cost, the drier air gives you a better operation and lower costs in the use of all air-operated tools and machines, paint spraying, sand blasting or moisture-free air cleaning. Water saving also means less expense for piping, pumping, water treatment and water disposal, or you get the use of water elsewhere in your plant where it may be badly needed.

Niagara Aero After Cooler assures all these benefits because it cools compressed air or gas below the temperature of the surrounding atmosphere; there can be no further condensation in your air lines. It condenses the moisture by passing the air thru a coil on the surface of which water is evaporated, transferring the heat to the atmosphere. It is installed outdoors, protected from freezing in winter by the Niagara Balanced Wet Bulb Control.

Write for complete information; ask for Bulletin No. 130

NIAGARA BLOWER COMPANY

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Niagara District Engineers in Principal Cities of U. S. and Canada

INDUSTRIAL COOLING HEATING • DRYING

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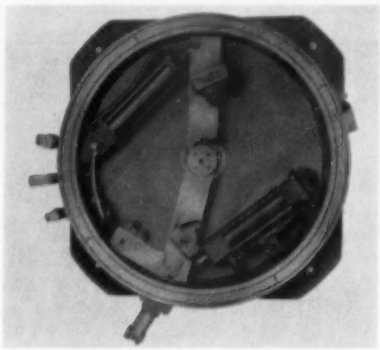
HUMIDIFYING • AIR ENGINEERING EQUIPMENT

Circle 22A on reply card

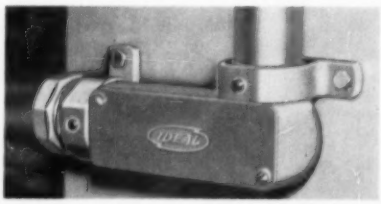
This equipment is especially suited for operation in chemical plants; pharmaceutical laboratories; film, optical and electronic factories; atomic energy installations; and in many other specialized industries. *Circle 20E on reply card*

Accurate indexing to plus or minus 0.0005-inch increments without the danger of over-indexing is possible with the Pitt, a 26-inch, heavy-duty, air-operated rotary indexing table. According to Pitt Industries, the manufacturer, the unit is designed to handle loads up to



500 pounds and an adjustable hydraulic control assures cushioned stops under all weights. Set-up work is simplified by a double solenoid valve equipped with push-button controls for rapid changing from automatic to manual operations. Two micro switches are mounted on the outside for easy adjustment. The device operates in a pressure range of 75 to 100 psi and is available with six to eighteen stations. *Circle 21E on reply card*

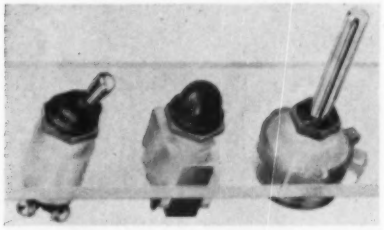
Hub-Lugs are holding devices that reportedly provide a simple, quick-fastening method that assures a moisture-proof, strong, durable mounting for fittings in electric control and operating systems on machinery. After the fixtures are placed over a conduit and required fittings have been attached, they are slipped back over the hub, tightened



with a wrench and secured to the machinery through holes in wings of the unit. The manufacturer, Ideal-Simplet Fittings, Inc., claims that breakdowns in old wiring systems caused by vapor, water and dust entering holes that had to be bored in the backs of fittings can now be eliminated.

Circle 22E on reply card

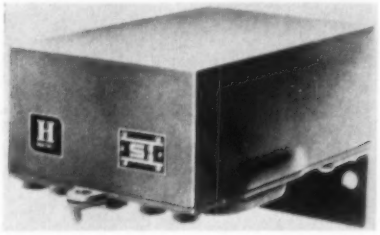
Automatic & Precision Manufacturing Company's high-pressure sealing devices (originally designed to meet military specifications) are now available to



commercial users in marine, air conditioning and refrigeration, food and chemical, portable tool and home appliance fields. Hexseals, as they are called, are switch "boots" that fit over standard push-button, toggle and rotary switches to seal out dust, moisture, vapors and other contaminants. Because they are of 1-piece construction around an integral nut, they replace standard panel mountings. They are effective even at high temperatures and are said to be resistant to petroleum and petrochemical products, abrasion, weather, sunlight and salt water.

Circle 23E on reply card

A computing device for pneumatic measurement or control circuits is now being marketed by the Industrial Division of Minneapolis-Honeywell Regulator Company, Wayne and Windrim Avenues, Philadelphia 44, Pa. The Sorteberg Force Bridge, as it is called, can convert into linear signals those from a square-



root flow transmitter, permitting the use of a flow receiver with an evenly graduated chart. Further, it can maintain a balance between two pneumatic signals for flow-ratio control, as well as multiply, subtract, divide or square pneumatic outputs. Its design assures friction-free operation by the use of an unique weigh-beam and fulcrum feedback principle.

Valvair Corporation has developed a directional-type valve that consists of a captive Hycar ball that shuttles between two seats in a Navy M bronze body. When pressure is applied at one port, the ball shifts to and seals the opposite opening. The fixture, installed as a T in inlet lines, permits changing from automatic to manual or double-source control. It

"MINE KING"

The Name to Remember When Buying Air Hose

STRONG!

Molded—and—braided construction, with materials and workmanship meeting the very highest standards for quality and reliability.

TOUGH!

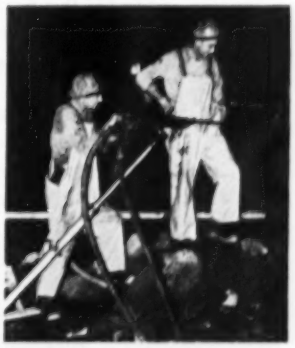
Extra durable smooth brown cover withstands severest abrasive wear; resists the shock of falling rock, tools and timbers; and prevents penetration of water into carcass.

FLEXIBLE!

Easier to handle under crowded, tight-spot drilling conditions, and when coiling for movement between locations.

LONG LENGTHS!

Availability in long lengths . . . up to 500 feet . . . permits "Mine King" to be used with fewer intermediate connections, reducing the time required for coupling and uncoupling.



A Goodall "Standard of Quality" product,

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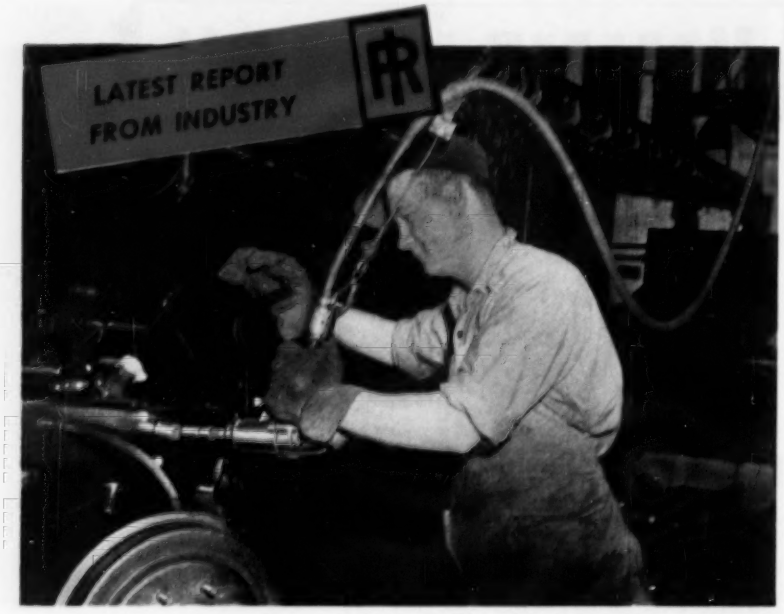
Circle 23A on reply card



New I-R Torque Control Impactools prove value on auto assembly line

A leading auto manufacturer reports greatly improved *product quality* on 3 auto and truck assembly line operations where Ingersoll-Rand Torsion Bar Torque Control Impactools have been used for 6 months.

A safety hazard is eliminated on one operation, where these new Impactools have made torque control possible for the first time. The photo above shows the I-R Size 5040T Torque Control Impactool securing the steering gear assembly to the truck frame.

Other major benefits include time saving, because these Impactools operate at full power and speed until they automatically shut off when pre-set torque is reached . . . and elimination of the need for hand torqueing on many nut running jobs.

Size 5040T 2 Torsion bars available with max. torques of 60 and 90 ft. lbs.

Write for the complete story on this latest I-R development!

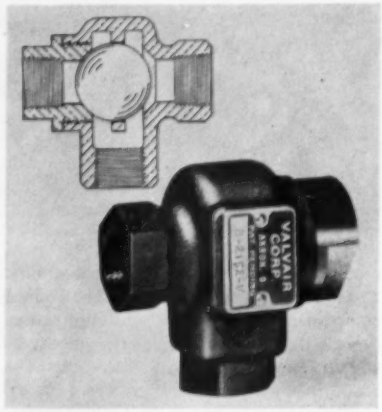
Ingersoll-Rand

11 Broadway, New York 4, N.Y.

8-346

Circle 24A on reply card

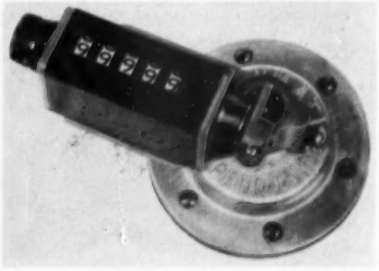
can also be used to prevent intermixing of two gases or liquids while they are being delivered alternately to a tank or similar container. According to the



manufacturer, this valve may be substituted for dual-top models and is suitable for use with air, oil, water or other fluids compatible with Hycar and bronze. It is available with ¼ and ⅜ NPT (National Pipe Thread) ports and the net open area between seat and ball is equal to the transverse area of a ⅜-inch standard pipe.

Circle 24E on reply card

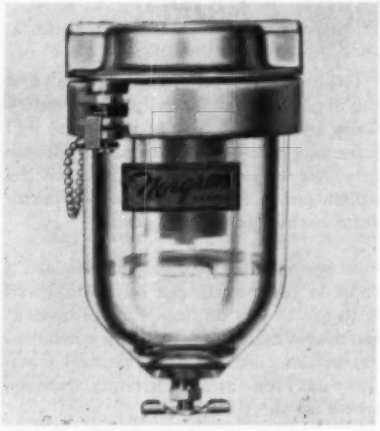
A line of highly accurate automatic counters for any operation controlled by pneumatic or hydraulic action has been announced by Pneumaticount. The units screw into lines controlling air or



hydraulic cylinders and can be installed in 5 minutes. There is no linkage to assemblies, no solenoid and no possibility of half or miscounts. The device, it is claimed, will outwear mechanical counters. Models, with five or six digits and knob or key reset, are available for 1- to 5000-psi pressure and up to 300 counts per minute.

Circle 25E on reply card

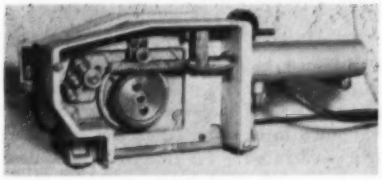
Redesign of C. A. Norgren Company's Series 30 AE compressed-air filters reportedly has increased efficiency in moisture removal and reduction of pressure drop over former models. Use of hinged-type clamp rings with a chained clasp pin has simplified servicing. Louver plates that set an improved cen-



trifugal air-flow pattern and a larger filter element help produce a higher efficiency than was possible previously.

Circle 26E on reply card

A 20- to 50-percent saving on labor costs, achieved through the development of an automatic air-operated tape dispenser, has been reported by Air



Fixtures, Inc. Electrical foot controls leave the operator's hands free to apply tape while the next predetermined length is metered out. As one piece is removed, a spring-wire-triggered snap-action switch sets the next tape-delivery cycle in motion. The length of each piece is directly related to the time of travel of an air cylinder. Dispenser service life is increased because pressure and speed controls are used and each unit can be reset to handle any type of pressure sensitive tape.

Circle 27E on reply card

"SAND WIPER"
rammer

SEALS OUT
sand and dirt
for
longer life
and
maximum
power

NEW

1. proven flapper valve
2. built-in cooling system
3. piston rod air seal
4. piston rod "sand wiper"

Exclusive new front-end design assures more efficiency, less wear and longer life. Sand, dirt, or abrasive material cannot enter the bore of the guide or the barrel to cause friction and wear. Compact, lighter-weight design improves handling. Balanced blows make the tool float over the work faster and easier. Write for form 5216 describing both bench and floor units or ask for a demonstration in your plant.

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

8-504

Circle 25A on reply card

NUGENT LUBRICATING SPECIALTIES LET YOU SEE WHAT'S GOING ON!

- **SIGHT FEED VALVES** provide a means of regulating and visually checking oil flow at the point of delivery to bearings, gears, etc.
- **SIGHT FLOW INDICATORS** tell you at a glance, or by the sound of an alarm bell, whether or not oil is flowing properly to vital parts.
- **MULTIPLE OILERS** are furnished in a variety of types with any number of feeds and will materially reduce lubrication costs for machinery with many enclosed or hard-to-get-at bearings.

Nugent manufactures a complete line of lubricating specialties. Write for descriptive literature mentioning the type of equipment you are interested in.

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Circle 26A on reply card

BRIEFS

Ground eggshell will perhaps find use in plastics, fertilizers, paints, poultry feeds and some types of medicinal and pharmaceutical preparations. A British firm has a provisional patent for the utilization of the material, which is calcium carbonate of high purity.

•

A new idea in petroleum production is to make some of the salt water produced with the oil pay off, too. One prominent southwest operator is erecting a bromine extraction plant. Dow Chemical Company has long obtained bromine from sea water on the Gulf Coast.

•

An automatic welding machine produced by Allied Welder Corporation, of Dearborn, Mich., contains 22 air cylinders. It was developed to fabricate so-called "X" members for automobile frames, and this involves the placing of 100 inches of weld on each one. The operator's only duty is to load stock blanks into the machine, which turns out three finished pieces a minute.

•

The French claim the most powerful lighthouse, located on the Isle of Ouessant. Rated at 500-million-candle-power light intensity, it has a 43-mile range of visibility in clear weather and its beam will penetrate fog for 13.5 nautical miles.

•

More than 100 years ago, according to Arthur Woodward, former curator of Los Angeles County Museum, consideration was given to transporting gold-seekers from the East to California by balloon. Although the idea was never carried out, it caused a stir of excitement.

•

Prof. Lucien Denoel taught coal mining in the University of Liege, Belgium, for 40 years. As a token of their gratitude his former students, now practicing their profession all over the world, have established the Lucien Denoel prize of 60,000 Belgian francs to be awarded annually for the best paper on certain phases of coal mining.

•

In 1955 accidents caused five times as much absenteeism among British workers as strikes did—20 million man-days versus 4 million. In factories, one out of every 40 employes is injured to some extent during the average year. Fatalities range around 700 and there are approximately 185,000 injuries that keep workers away from their jobs for 3 days or longer.

•

Vacuum metallurgy has become so important that New York University has scheduled 25 lectures on the subject to be delivered next June 10 through 14. Speakers will be specialists from various parts of the world.

R. G. LeTourneau, Inc., is building an off-shore drilling vessel for Deepwater Exploration Company of Houston, Tex. Designed to drill to depths of 10,000 feet in up to 70 feet of water, the 121x118-foot platform will incorporate living quarters for 22 men, storage facilities for equipment and a landing deck for helicopters as well.

•

The Scandinavian Air Lines System (SAS) has flown almost 20,000 passengers over the North Pole between Northern Europe and Los Angeles since November 15, 1954—approximately 14,000 of them in the past year. The two flights a week in each direction originally scheduled have been increased to daily service. Transpolar flights between Scandinavia and Japan are to be started this month.

•

An oil well having a flow estimated at 60,000 to 80,000 barrels a day has been brought under control in Iran after having delivered 1½ million barrels that was impounded behind earth dams. This accumulation is being sold for fuel oil and it is estimated that it will pay for all the exploratory and drilling work done in the area during the past years.

•

Construction of a filtering plant to keep the harbor and its shores free from waste-oil is planned at the more than 10-mile long, 38-foot deep Port of Stockholm, Sweden. After water and oil taken from the sea have been separated the water will be returned to the ocean and the oil residue will be burned.

•

In Los Angeles, Calif., L. J. Koch has proposed to make rain clouds by spraying water from the top of a floating tower. The device is, in essense, a stack, supported by four floats and pulled by a tug. Water is scooped up at the base, forced upward in a spiral course by propellers and mixed with air. The resulting mist is then discharged into the air.

•

A hazard of highspeed aviation is hitting birds in flight. In an effort to develop windshields that will withstand the impact, the Civil Aeronautics Administration has rigged up an air-operated gun that hurls dressed poultry at the panels. The apparatus is called the "Bird Impact Test Facility."

•

Another ski run near New York City has installed equipment for "making" snow. It is the Silvermore slope in the Harriman section of Palisades Interstate Park. The snow-forming machines, resembling lawn sprinklers, spray a mixture of water and compressed air into the atmosphere when the temperature is below freezing. The new installation is the third to be made among the 23 skiing centers within easy traveling distance of New York.

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BETTER Power...
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Circle 27A on reply card

Industrial Literature

A complete line of forged-steel gate and needle valves specifically designed for the petrochemical, power and process industries is described in a 12-page bulletin (No. DH-80) released by the R-P&C (Reading-Pratt & Cady) Valve Division of American Chain & Cable Company, Inc. The folder lists material specifications, pressure and temperature ratings, dimensions and applications.

Circle 28E on reply card

Brochure T-50 is the first of a series of bulletins detailing mechanical, thermal and electrical properties of Teflon, the Du Pont trademarked variety of tetrafluoroethylene resin. It is issued by Halocarbon Division of Haveg Industries, Inc., which has used the material to produce lined steel pipe, heavy- and light-wall tubing, sheet, coated wire and special molded and machined parts. *Circle 29E on reply card*

The Kuhns Brothers Company lists and describes its line of ductile cast iron fittings whose extra strength permits design of lightweight units for installations where heaviness is a factor, in Catalogue No. 1.

Circle 30E on reply card

Synchronous speed combined with induction simplicity is a feature of Allis-Chalmers Manufacturing Company's Synduction motor. Units from ¼ to 40 hp are available in drip-, splash- and explosion-proof designs. Because each machine is being engineered for individual requirements, Bulletin 51B-8440A lists only information needed to facilitate final specifications and quotations.

Circle 31E on reply card

For readers interested in manual, magnetic and reduced-voltage starters; push buttons; relays; limit switches; solenoids; pressure and vacuum, float and plugging and anti-plugging switches, General Electric Company has published a manual (GEA-6372) describing its products in this field. Data on where each is available and applications for it are given.

Circle 32E on reply card

An electric-powered fork truck with a capacity of 6000 pounds is described in a release from The Elwell-Parker Electric Company. According to the bulletin, two types are available: a 68-inch high model for freight-car and truck loading and an 83-inch one for high-tiering. Further specifications and diagrams are available in flyer No. F31T6. *Circle 33E on reply card*

Clips for support of fluid system lines, a dual heat transfer coil for cooling applications, a pressure snubber for protection of gauges and a manifold valve to simplify cleaning draft-gauge lines are described in Catalogue 4395 issued by W. D. Wynant Tube & Hose Fitting Division of The Parker Appliance Company.

Circle 34E on reply card

Structural applications, mechanical properties and a comparison of aluminum and steel sections are presented in a 12-page publication issued by Harvey Aluminum Structures. The booklet details the company's facilities for producing aluminum extrusions as well as design concepts for using the metal.

Circle 35E on reply card

Planning the High Vacuum System is featured in a 24-page bulletin (No. 9) published by Central Scientific Company. Capacity, speed and dimension tables, price lists and photographs are included as well as a detailed outline of the correct procedure involved in and what equipment should be used for various vacuum-system installations. *Circle 36E on reply card*

Permawick, a self-wicking liquid lubricant, can replace tedious hand-lubricating methods according to a bulletin issued by Fluidwick Company. This material, consisting of oil and cellulose base fibers, provides high-speed automatic wicking and oiling of sleeve-bearing assemblies in electric motors, generators, pumps, blowers, etc.

Circle 37E on reply card

Immunol, a non-alkaline, non-acid detergent that cleans, degreases and rustproofs metal in one operation, is the topic of a 12-page booklet issued by Harry Miller Corporation. The non-flammable cleaner is said to mix with either hot or cold, hard or soft water and may be applied by wiping, dipping or spraying.

Circle 38E on reply card

Data on fittings and O-ring adapters designed to satisfy 1956 Society of Automotive Engineers standards are contained in Anchor Coupling Company's *SAE Boss Fittings Catalogue*.

Circle 39E on reply card

Prescribed Lighting Protects the Eyes of Industry, a 28-page booklet made available by Sylvania Electric Products, Inc., features sections on safety and visibility factors; standards for use in prescribing plant lighting; uses of fluorescent, incandescent and mercury vapor lamps; maintenance; and data on fixtures. Halftones, sketches and charts supplement the text.

Circle 40E on reply card

Fundamentals of spring design are presented in an 8-page brochure, *Spring Design and Selection—in Brief*, published by Associated Spring Corporation. Basic stress and deflection formulas, the commonly used materials, typical applications and certain limitations for each type of spring are included in the discussion, which is amplified by means of charts and graphs.

Circle 41E on reply card

High-efficiency cleaning of atmospheric air by means of specially adapted industrial cloth-filter-type dust collectors is the subject of Bulletin No. 557-D published by Wheelabrator Corporation. The units are particularly applicable to rooms housing heat-generating electrical equipment, laboratories where dust-free atmosphere is required, and similar locations.

Circle 42E on reply card

Fulton Sylphon Division of Robertshaw-Fulton Controls Company has published a 22-page bulletin that describes and illustrates its complete line of packless valves for applications involving hazardous liquids and gases. *Circle 43E on reply card*

Information on standard and special types of gaskets cut from a wide range of material is given in a 28-page catalogue published by Chicago-Wilcox Manufacturing Company, 7701 South Avalon Avenue, Chicago 19, Ill. A valuable feature is a section listing more than 1500 available stock dies. Copies may be obtained by writing directly to the company.

Aftercooler and Cyclone Separator designed for cleaner, dryer compressed air

R. P. ADAMS CO., INC.
209 East Park Drive, Buffalo 17, New York

The Adams Aftercooler and Cyclone Separator are designed to efficiently condense and remove water from compressed air and process gas. Condensed moisture and entrained dirt and oil are subsequently removed in a cyclone type separator. This unit is scientifically designed for maximum removal efficiency over a wide range of flow rates.

For normal use, units are available to cool gases to within 10° F of the temperature of the cooling water. Specially designed units are available to permit a 2° F approach to cooling water temperature, for application where low moisture content is critical.

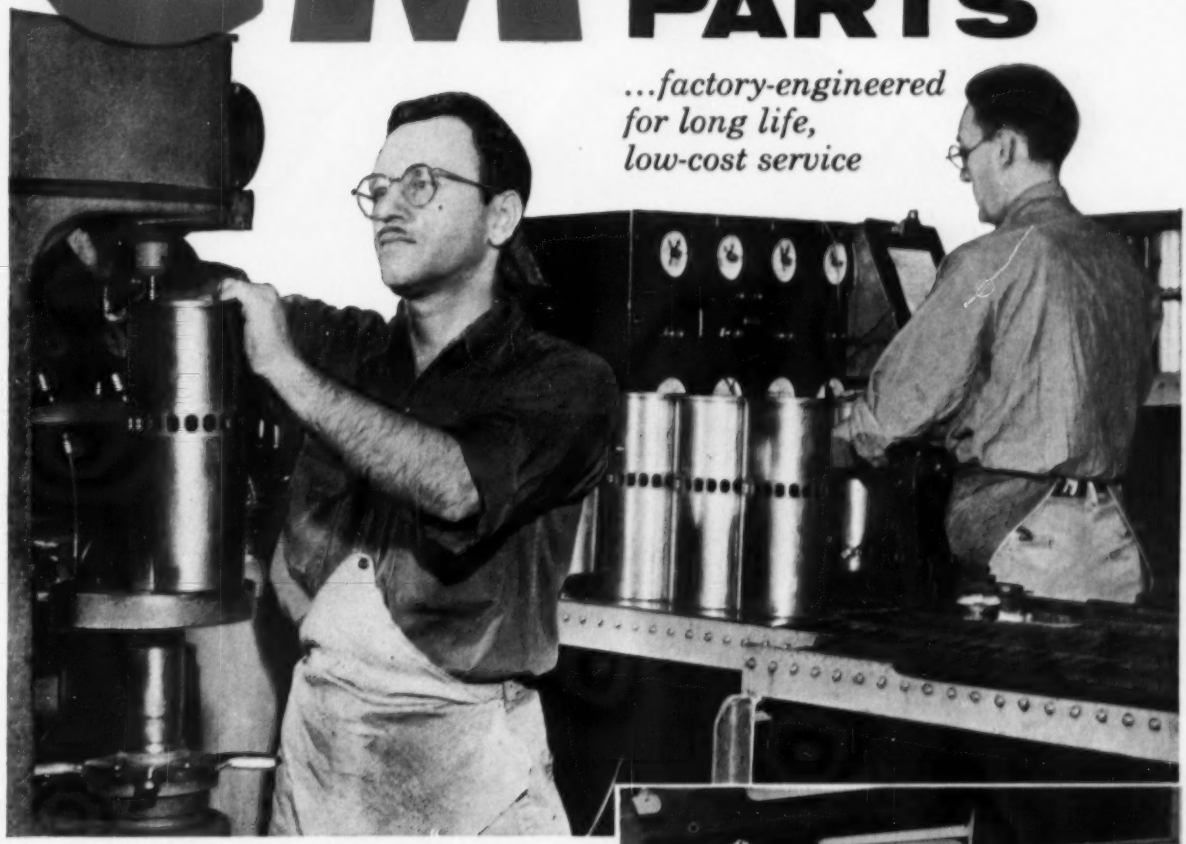
Adams Aftercoolers and Separators are available from stock to handle 20 - 40,000 cfm with 10° cooling and 25 - 19,200 cfm where it is necessary to cool within 2° F of the cooling water. Special units can be supplied to suit an unlimited range of requirements. In all cases, a pressure drop of ½ psi is assumed at a maximum working pressure of 150 psi.

This wide range of sizes enables the cost-cutting application of Adams Aftercoolers and Separators in virtually all industrial application. For further information on how R. P. Adams' units will serve your compressed air problems and save you money, write today for Bulletin 711.

Circle 28A on reply card

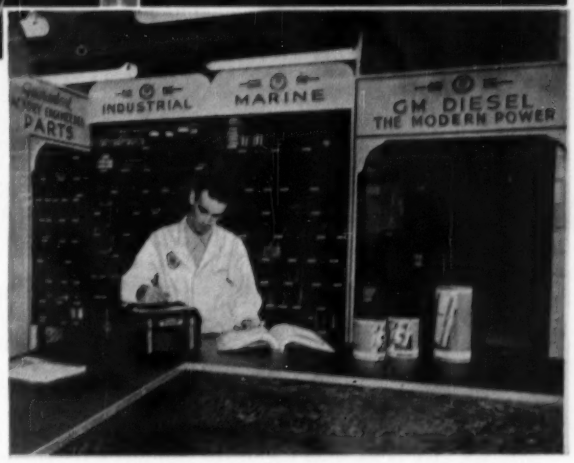
GM DETROIT DIESEL PARTS

...factory-engineered for long life, low-cost service



CYLINDER LINER QUALITY CONTROL

In checking the metal's hardness for wear resistance, diameter dimensions are measured electrically as well as mechanically to insure perfect fit and interchangeability. Even the smoothness of the ground liner surface is recorded by this "on-the-production-line" inspection.



MODERN PARTS DEPOTS ALWAYS NEARBY

GM Detroit Diesel Distributors and Dealers from coast to coast carry complete stocks of factory-engineered GM Detroit Diesel parts. They're as near as your telephone—ready "round the clock" to keep your engines working and earning for you.

You're always money ahead when you buy factory-engineered parts from your Distributor or Dealer

GM GENERAL MOTORS DIESEL POWER

DETROIT DIESEL

Engine Division of General Motors

Detroit 28, Michigan

Single Engines . . . 30 to 800 H.P. Multiple Units . . . Up to 895 H.P.

Circle 29A on reply card

Wire Rope at Work—At Hawley, in the beautiful, rolling Pocono Mountains, is a big hydroelectric plant operated by the Pennsylvania Power & Light Company. Thirty or more years ago, PP&L constructed a wood-stave flow line connecting the plant to the Lake Wallenpaupack dam, 3½ miles away. Approximately 8500 ft of this system was recently replaced with a huge steel pipe line, 14 ft 8 in. in diameter. The photograph shows one stage of construction work.

Lifting the ponderous fabricated pipe was a job in itself. But with Bethlehem wire rope handling the principal lifts, the task of moving the heavy sections was managed smoothly. It was the type of job that this strong, tough rope always takes in stride, no matter how heavy or cumbersome the load.

Bethlehem Steel Company, Bethlehem, Pa. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

Mill depots and distributors from coast to coast stock Bethlehem rope for the following industries and numerous others:

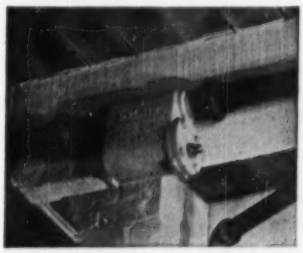
CONSTRUCTION • EXCAVATING • MINING • QUARRYING • PETROLEUM • LOGGING • MANUFACTURING

DEPENDABLE PNEUMATIC SERVICE

WHEN EQUIPMENT IS PROTECTED BY

DRIAIR

A COMPLETE SELF-CONTAINED UNIT



DriAir may be installed by suspending it from the piping, without any other support, or may stand on the floor near equipment being protected.

DRIAIR speeds production by separating and automatically ejecting the condensed water and oil from the air. DriAir collects dirt and rust from the air lines and delivers clean dry air to the tools, thus reducing wear and prolonging their life. All internal parts are made of bronze or copper—resistant to corrosion and practically permanent. Copy of Bulletin DA fully describing the operation of DriAir sent on request.

NEW JERSEY METER COMPANY

PLAINFIELD, NEW JERSEY

Circle 31A on reply card

MAYFIELD, Wash.—Workmen, held by safety ropes, drill away on a cloudy stone cliff high above roiling Cowlitz River to prepare abutment for Tacoma City Light's $37,000,000 Mayfield Dam being built to bring needed electrical energy to the northwest Washington area.

NO MATTER WHERE YOU GO—

If You See Hose, You'll See

PUNCH-LOK HOSE CLAMPS

Write for Descriptive Literature or
See Your Nearby PUNCH-LOK Distributor

"The Sign of a GOOD Hose Clamp"

PUNCH-LOK Company

6437 Dept. H, 321 North Justine Street, Chicago 7, Illinois

Circle 32A on reply card

1913

1925

1935

1945

How **43 YEARS OF PROGRESS** by Ingersoll-Rand has made TIE TAMPING TODAY faster, easier and more economical than ever before

Remember when tie tamping used to be a slow, laborious, back-breaking job – done entirely by sheer muscle power? Thanks to Ingersoll-Rand, those days are gone forever.

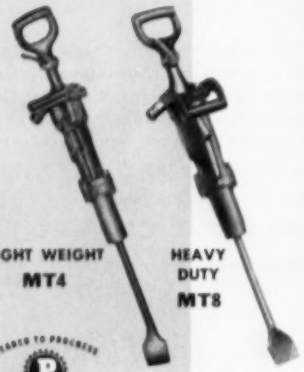
The first railroad compressor (now reposing in the Smithsonian Institute) was introduced by Ingersoll-Rand in 1913 – and with it, the first air-operated tie tamper. This I-R air-power team revolutionized tie tamping almost overnight. Air tamping not only did a far better and more uniform job – it actually cut tie tamping time in half!

Since 1939, tremendous progress has been made in railroad compressor equipment. Today, modern rail- and rubber-tire mounted Gyro-Flo rotary compressors, in 85, 125, 210, 315, 600 and 900 cfm sizes, represent the very last word in large-capacity portable units for maintenance of way service. With no compressor pistons, rings, rods or valves, it has been acclaimed as the most maintenance-free compressor ever developed.

And for a four-tamper crew, the Ingersoll-Rand Spot-Air compressor gives you a completely self-contained, 36-cfm, 80 psi air power plant that weighs only 265 lb. complete. You can set it just about anywhere, and with wheelbarrow mounting, moving it around is an easy, one-man job. For the whole cost-saving Spot-Air story, send today for your copy of Bulletin 2264B.

1956
RAIL MOUNTED GYRO-FLO

MODERN I-R TIE TAMPERS



LIGHT WEIGHT MT4

HEAVY DUTY MT8

1956 SMALL, LIGHT-WEIGHT SPOT-AIR COMPRESSOR
operates four Tie Tampers

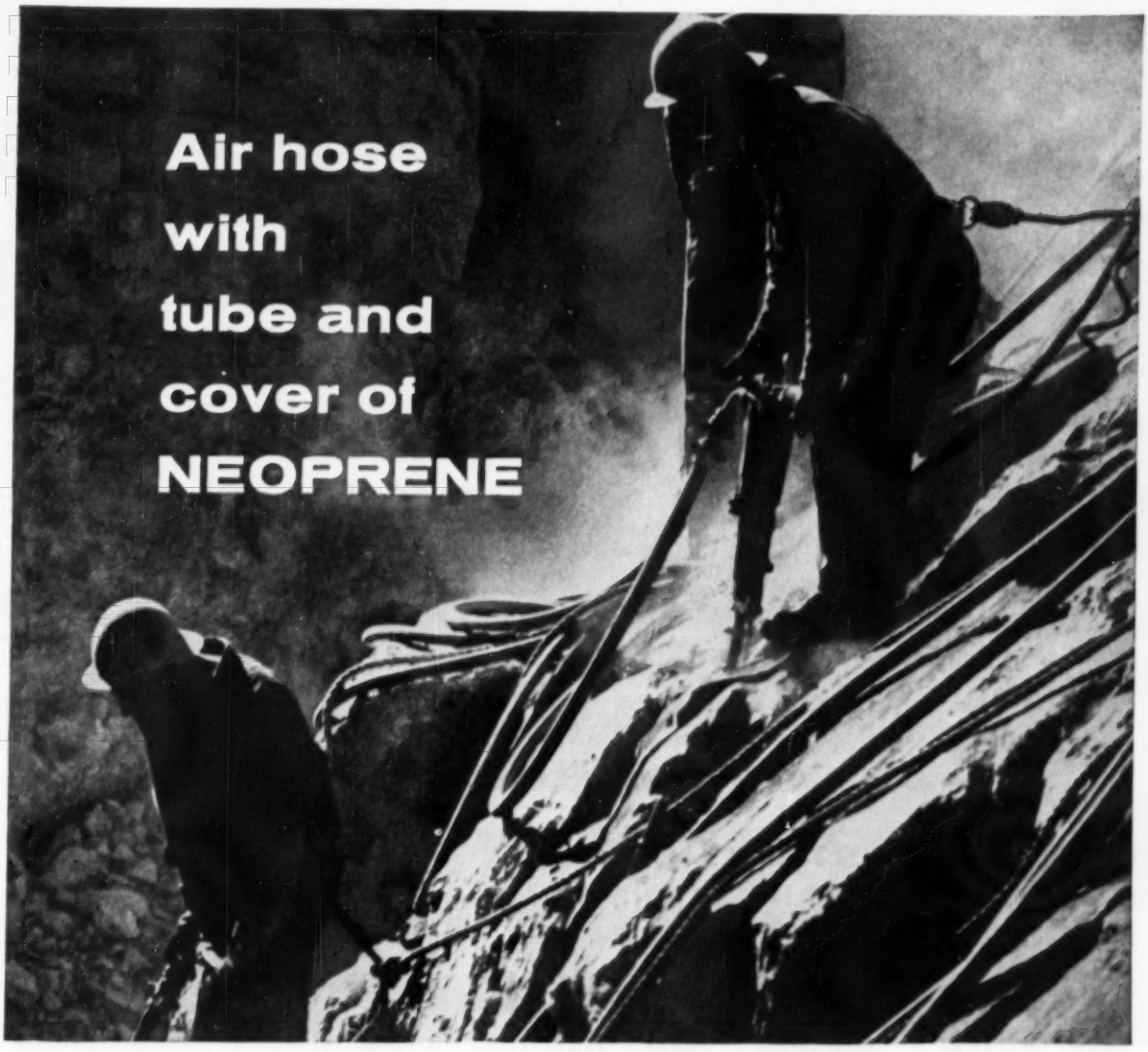
GEARED TO PROGRESS
PRI MEMBER

Ingersoll-Rand

11-449 11 Broadway, New York 4, N. Y.

COMPRESSORS • CONDENSERS • AIR & ELECTRIC TOOLS • TURBO-BLOWERS • PUMPS • ROCK DRILLS • GAS & DIESEL ENGINES

Circle 33A on reply card



Blistering heat, jagged rocks—but still this hose gives long service!

It takes more than rugged outdoor service to damage air hose made with Du Pont neoprene. This hose thrives on the tough jobs—it's protected inside and out.

Rugged neoprene hose tubes are flexible, resist the attack of hot lubricating oil in the air stream. No tube particles crumble off to clog tool parts.

Covers of neoprene protect the fabric of the hose when it is dragged and twisted over sharp and abrasive objects. The neoprene covers give lasting protection because neoprene resists the deteriorating effects of oil and grease, sunlight and weather.

This double-duty protection, inside and out, is the reason why neoprene cover and tube is used on most compressed air hose. The next time you order hose be sure to specify Du Pont neoprene.

FREE! The Neoprene Notebook
Each issue brings you new, unusual applications of neoprene . . . new products . . . interesting articles. Send in this coupon.

NEOPRENE
The rubber made by Du Pont since 1932

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
Elastomer Chemicals Div. CA-2
Wilmington 98, Delaware

Name _____ *Position* _____

Firm _____

Address _____

City _____ *State* _____

Circle 34A on reply card

new...

pre-lubricated take-up bearings

SLASH maintenance costs

Pre-Lubricated At Our Factory For Life • Seals Lubricant In—Dirt Out • Standard Series Ball Bearings • Self-Aligning • Frames of Welded Structural Steel • Can be Operated in Tension or Compression

Woods

T. B. WOOD'S SONS COMPANY

CHAMBERSBURG, PA.

Cambridge, Mass. Newark, N. J. Dallas, Texas Cleveland, O.

Circle 35A on reply card

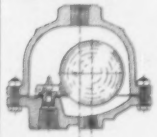
PROTECT COMPRESSED AIR TOOLS

Your Guide to Correct Air Trap Selection

For automatic draining of water from compressed air or gas systems.

Line Drips—

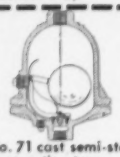
No. 21 direct acting ball float trap is recommended for most installations. Direct acting...most commonly used trap.



No. 21 cast semi-steel Air Trap

Air Line Separators—

If free from oil or sludge, use No. 71 snap-action trap. Spring-loaded valve snaps wide open and shuts tight. This action is particularly desirable when liquid load is light. Grit will not lodge between valve and seat.



No. 71 cast semi-steel snap-action trap.

Intercoolers, Aftercoolers, and Large Receivers—

Usually contain heavy oil or sludge that fouls up any ball float trap. Use No. 213 inverted bucket trap with a scrubbing wire to provide positive drainage and freedom from maintenance.

No. 213 inverted bucket trap with scrubbing wire. Also forged steel models for pressures above 250 lbs.

Ask for free Bulletin No. 2022 . . . see your local Armstrong Representative or write: Armstrong Machine Works 8651 Maple St., Three Rivers, Mich.

Satisfaction Guaranteed

ARMSTRONG AIR TRAPS

Circle 36A on reply card

GET THE MOST OUT OF YOUR COMPRESSED AIR EQUIPMENT . . . SPECIFY

CONRADER UNLOADER VALVES

New Models . . . Smaller . . . More Compact

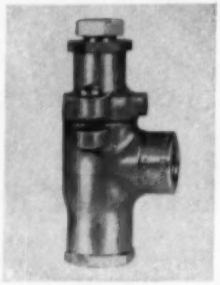
- Positive operation in any position.
- Adjustable differentials.
- Operating pressures from 4 p.s.i. to 600 p.s.i.
- Standard on leading compressors.

Conrader's exchange service trades you a completely rebuilt valve for an old one with new valve guarantee.

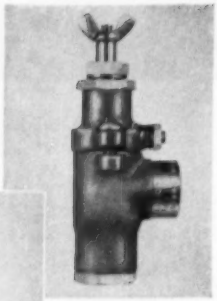
One day service on repairs.

Conrader is equipped to custom design special valves in pressures to 1000 p.s.i.

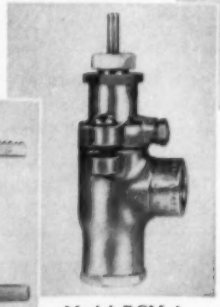
Distributor Franchises Open.



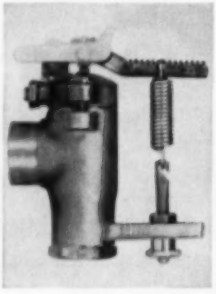
Model RCW



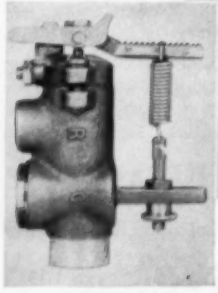
Model RCM-A with hand unloader



Model RCM-A



Model RCF



Model RCS (Available with drain cock)

R. CONRADER CO. INC.

Box 924 ERIE, PA. Since 1925

Circle 37A on reply card

Circle 38A on reply card

. . . and the World Over

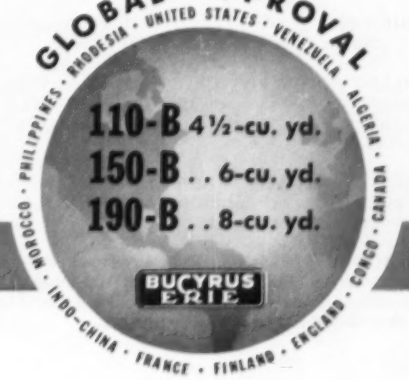
BUCYRUS-ERIE SHOVELS

Hold Down Mining Costs

The combined high production and consistent reliability of Bucyrus-Erie Ward Leonard electric shovels keep hauling units on the go day after day, month after month for top efficiency. A typical example is this 6-yd. shovel, one of three Bucyrus-Erie 150-B's stripping waste rock and dirt for a large Montana mining company.

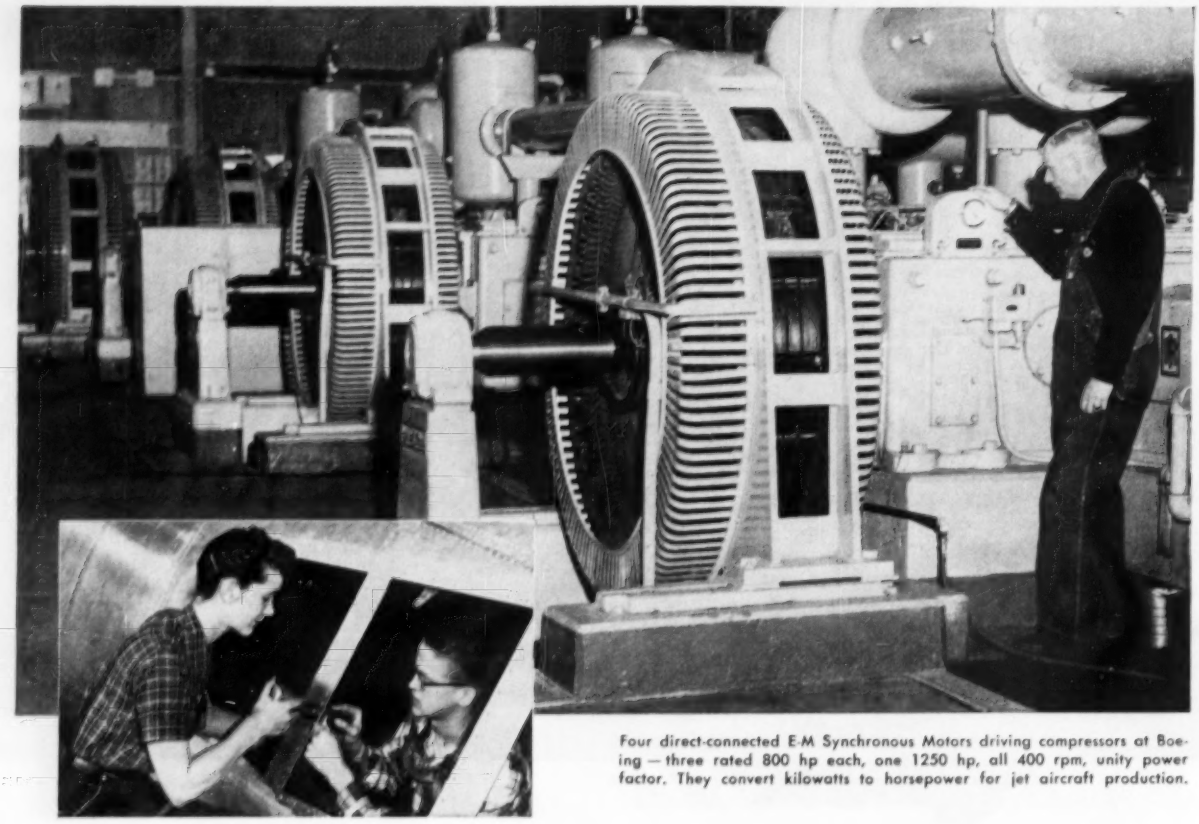
In mines all over the world, Bucyrus-Eries in the key spots help assure economical operation, regardless of conditions. Investigate their design and construction and you'll see why. Smooth-acting Ward Leonard control means extra fast acceleration and deceleration to speed work cycles. Superior front-end design provides high strength without dead weight. Heavy-duty construction throughout assures long machine life and low maintenance costs.

We would be pleased to give you complete information on how Bucyrus-Erie excavators can keep your dirt-moving costs in line. 95L56C


GLOBAL APPROVAL
MOROCCO · PHILIPPINES · RHODESIA · UNITED STATES · VENEZUELA · ALGERIA · CANADA · CONGO · ENGLAND · FINLAND · FRANCE · INDO-CHINA
110-B 4½-cu. yd.
150-B . . 6-cu. yd.
190-B . . 8-cu. yd.
BUCYRUS ERIE

BUCYRUS-ERIE COMPANY

SOUTH MILWAUKEE, WISCONSIN



Four direct-connected E-M Synchronous Motors driving compressors at Boeing — three rated 800 hp each, one 1250 hp, all 400 rpm, unity power factor. They convert kilowatts to horsepower for jet aircraft production.

How many rivets in a B-52?*

While big E-M Motors are turning giant compressors at Boeing, hundreds of air powered production tools are busily soaking up the air supply. *The rivet guns alone, believe it or not, drive some 900,000 rivets into each B-52. And Boeing's tight schedule at Plant Two, Seattle demands a tremendous supply of air for experimental and test work as well as for production tools.

Big users of compressed air in many industries have found that E-M Synchronous Motors give them the best all-around service. Here are the reasons you, too, will get better performance from E-M Synchronous Motors:

1. **HIGH EFFICIENCY.** They give you low cost conversion of electric power to mechanical power.
2. **PLANT POWER FACTOR CORRECTION.** E-M Synchronous Motors can be designed to operate at unity or 0.8 leading power factor to further reduce plant power costs.
3. **LESS SPACE, LESS MAINTENANCE.** Direct connection minimizes space requirements and simplifies installation and maintenance.
4. **SMOOTH STARTING.** E-M-invented *Polarized Field Frequency Relay* system has full-time, "conscious" control of the motor's speed during starting and synchronizing . . . and while running.
5. **SAFETY.** E-M Sa-Fuse High Voltage Control gives motor and operator complete protection. It also permits quick, safe manual fuse replacement without a hookstick.

For more information about E-M Synchronous Motors and Sa-Fuse Control and what they can do for *you*, see your nearest E-M sales engineer, or write the factory for brochure, *Synchronizer* No. 42.

Ask your own engineering staff — For the best possible installation, have your own engineering staff specify the motor. They know the requirements and can get competent help from the nearest E-M Field Engineer.

ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

E-M

1200-TPA-2169

Specialists in making motors do
EXACTLY WHAT YOU WANT THEM TO

Nickel alloy steel piston in percussion drill head stands brutal 200-blow-per-minute pounding

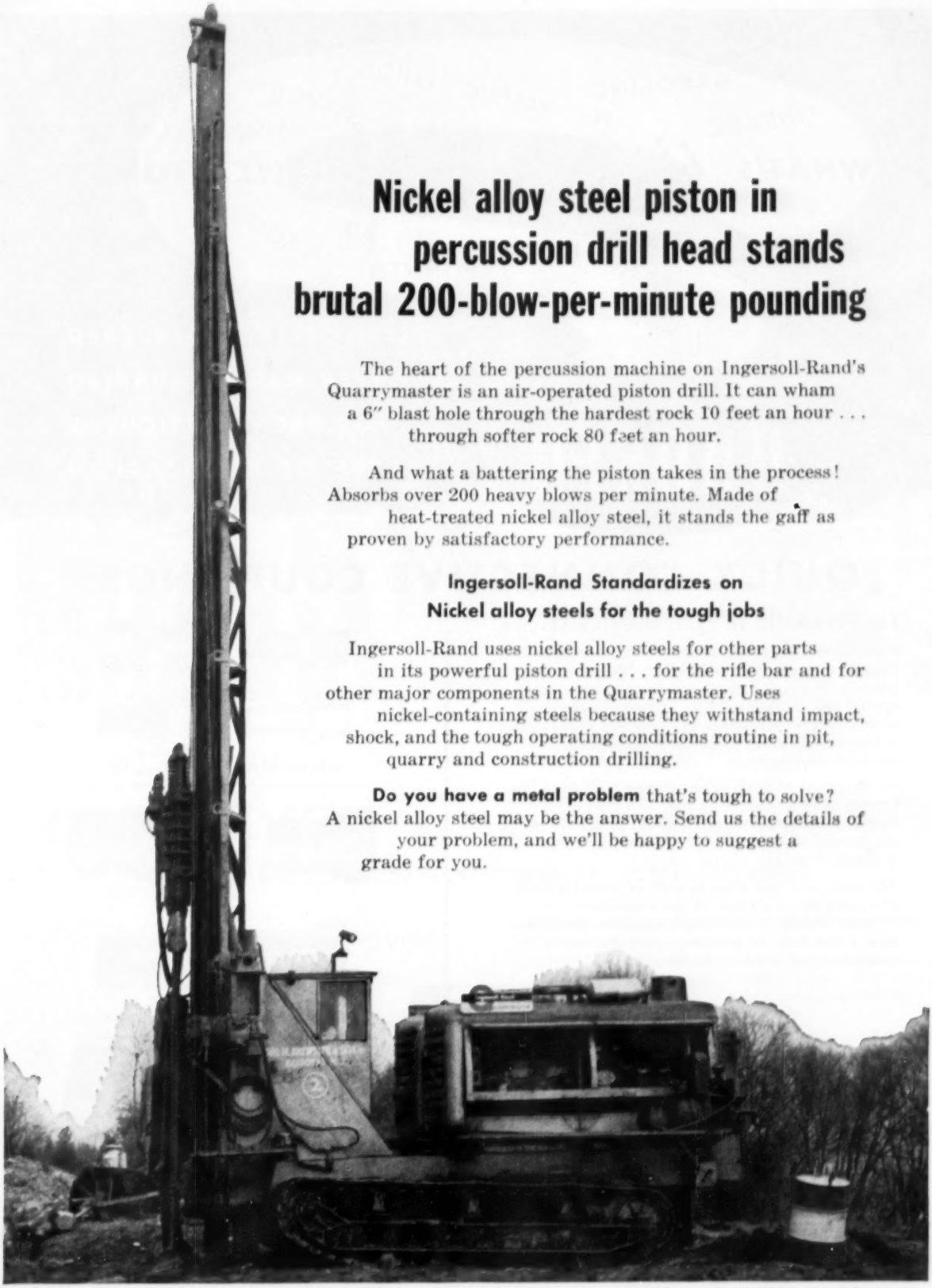
The heart of the percussion machine on Ingersoll-Rand's Quarrymaster is an air-operated piston drill. It can wham a 6″ blast hole through the hardest rock 10 feet an hour . . . through softer rock 80 feet an hour.

And what a battering the piston takes in the process! Absorbs over 200 heavy blows per minute. Made of heat-treated nickel alloy steel, it stands the gaff as proven by satisfactory performance.

Ingersoll-Rand Standardizes on Nickel alloy steels for the tough jobs

Ingersoll-Rand uses nickel alloy steels for other parts in its powerful piston drill . . . for the rifle bar and for other major components in the Quarrymaster. Uses nickel-containing steels because they withstand impact, shock, and the tough operating conditions routine in pit, quarry and construction drilling.

Do you have a metal problem that's tough to solve? A nickel alloy steel may be the answer. Send us the details of your problem, and we'll be happy to suggest a grade for you.



INCO TRADE MARK

THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N. Y.

GASOLINE
GREASE
HYDRAULIC FLUIDS
OXYGEN
WATER
WHAT'S *Your* COUPLING APPLICATION?
STEAM
AIR
VACUUM
OIL
ACETYLENE
REFRIGERANTS
COOLANTS

SPECIFICALLY ENGINEERED
. . . NEVER MERELY ADAPTED
. . . FOR EACH PARTICULAR
TYPE OF APPLICATION

HANSEN

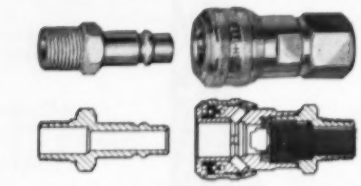
QUICK-CONNECTIVE COUPLINGS

For Pneumatic or Hydraulic Line Service

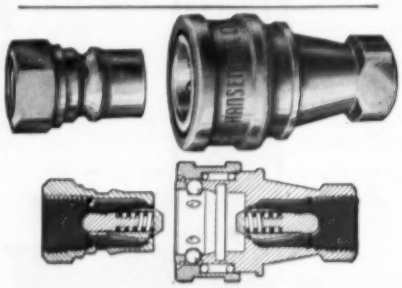
Regardless of whether your particular application requires One-Way Shut-Off, Two-Way Shut-Off, or Straight-Through Couplings—or Couplings for special service on fluid lines carrying oxygen, acetylene, gasoline, steam, etc.—you can always select a Hansen Coupling specifically engineered for your requirements.

As the result of years of experience with fluid line layouts in thousands of plants, each type of Hansen Coupling is carefully designed to incorporate the specific features needed for the job it is intended to do.

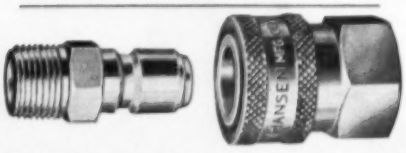
The next time you plan to alter or install a fluid line hook-up, make use of the know-how of your nearest Hansen representative. You'll find him a real help in getting *exactly* the Couplings you need to do the job.



ONE-WAY SHUT-OFF



TWO-WAY SHUT-OFF



STRAIGHT-THROUGH COUPLING

Write for the Hansen Catalog

Here's an always ready reference when you want information on Couplings in a hurry. Lists complete range of sizes and types of Hansen Quick-Connective Couplings. Write for your copy.

Representatives in Principal Cities

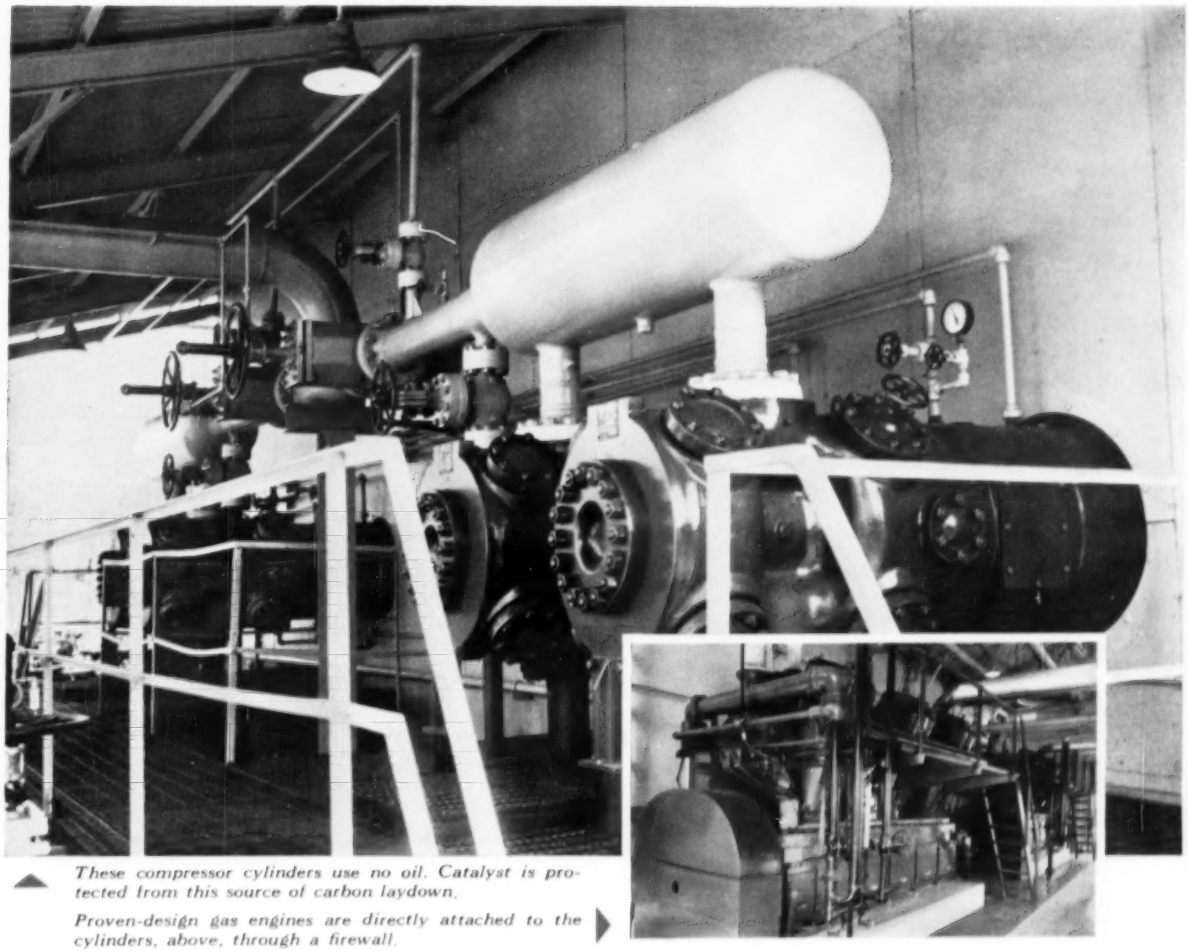
SINCE 1915 ®

QUICK-CONNECTIVE FLUID LINE COUPLINGS

THE HANSEN MANUFACTURING COMPANY

4031 WEST 150th STREET • CLEVELAND 11, OHIO

Circle 40A on reply card



These compressor cylinders use no oil. Catalyst is protected from this source of carbon laydown.

Proven-design gas engines are directly attached to the cylinders, above, through a firewall.

CATALYST LASTS LONGER

with NL compressor cylinders

No oil to carry over in the recycle gas

One feature of the Platforming process, developed and designed by Universal Oil Products Company, is long catalyst life without regeneration. That means a low catalyst cost per barrel of high-octane gasoline. That's why Skelly Oil Company's Platformer at El Dorado, Kansas, uses Ingersoll-Rand compressors with 'NL' non-lubricated cylinders.

In NL cylinders there is no oil to carry over in the recycle gas into the catalyst-packed reactor. Presence of oil would result in carbon laydown (coating which renders catalyst inactive). Oil also causes excessive hydrocracking and formation of undesirable polymers.

The pistons of NL cylinders are supported by graphitic carbon rings sliding in a mirror-smooth bore. Operation is dependable without oil lubrication.

Cylinders are connected to the gas-engine frame by special two-compartment distance pieces that are sealed and vented to allow safe handling of the hydrogen-laden gas.

The two 660-hp KVG compressors handle a total of 73 million cubic feet of gas a day, boosting pressure from 450 psi to 610 psi. Using available gas, their four-cycle, V-angle engines produce low-cost power at all loads.

Ask your I-R representative for complete information on Ingersoll-Rand gas-engine compressors and non-lubricated compressor cylinders. Obviously standard oil-lubricated compressors should be used wherever possible to reduce first cost and maintenance.

Ingersoll-Rand

11 Broadway, New York 4, N. Y. 6-471

COMPRESSORS • AIR TOOLS • ROCK DRILLS • TURBO-BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS • GAS & DIESEL ENGINES

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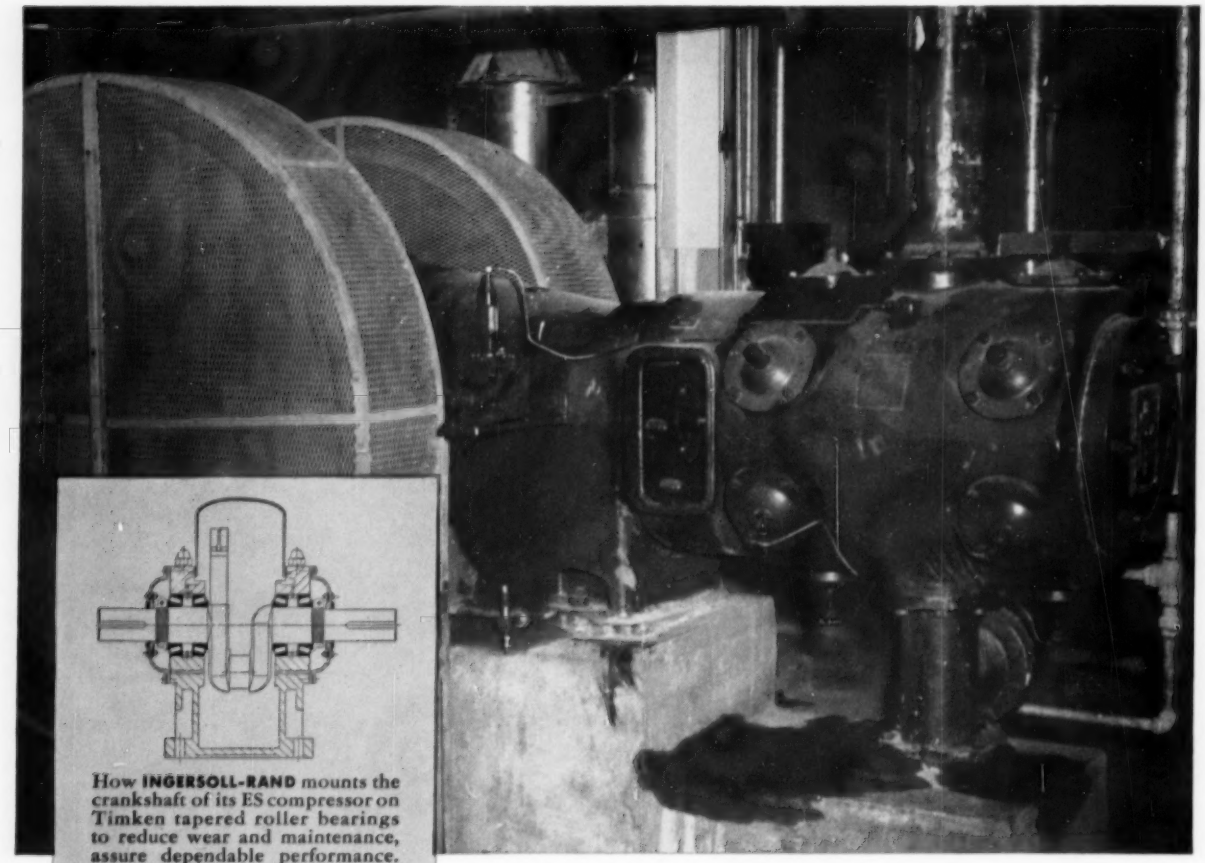

How **INGERSOLL-RAND** mounts the crankshaft of its ES compressor on Timken tapered roller bearings to reduce wear and maintenance, assure dependable performance.

Steady supply of air, less wear, with TIMKEN® bearings on the job

THIS Ingersoll-Rand ES compressor supplies steady air in a plant of a major timber company. To assure dependable performance and minimize compressor wear, the crankshaft is mounted on Timken® tapered roller bearings.

The tapered construction of Timken bearings enables them to take both radial and thrust loads in any combination. The crankshaft is held in positive alignment. Wear on adjacent moving parts is held to a bare minimum. And bearing closures are more effective because Timken bearings keep housings and shafts concentric. Lubricant stays in; dirt stays out, further reducing maintenance.

Compressor power loss is less, because Timken bearings practically eliminate friction. They're designed to have true rolling motion, and precision-made to live up to their design.

Even Timken bearing steel is specially made. We make it ourselves—America's only bearing manufacturer that makes its own steel.

Only Timken bearings give you *all* these advantages. Make sure you get them in the machines you buy or build. Always look for the trademark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

NOT JUST A BALL ○ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭
BEARING TAKES RADIAL ◐ AND THRUST →◐← LOADS OR ANY COMBINATION →✦←

REVOLUTIONARY BUCYRUS PLANT HELPS HOLD DOWN RISING COSTS

At a new plant in Bucyrus, Ohio, the Timken Company has substantially reduced the cost of tapered roller bearings by: 1) producing these bearings under a new system of extreme mechanization; 2) standardizing on 15 bearing sizes with the widest applications throughout industry. Manufacturers can take advantage of these lower costs by redesigning applications to use these Bucyrus sizes. And as more switch to Bucyrus bearings, production costs can drop still further, meaning even lower costs to you.

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